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COVER PICTURE
An attractive glimpse of the Denmark River as it flows through the Denmark Research Station

IN THIS ISSUE

	Page
New Minister for Agriculture	5
Grinding Shearing Combs and Cutters — M. Butler and D. A. Young	7
A Turkey-Raising Experiment — H. D. Hessels	19
Pasture Regeneration in East Kimberley — W. M. Nunn	23
Farm and Home—The Sauce Is So Important — M. Spencer	29
Weeds of Western Australia—Stinkwort — G. R. W. Meadly	33
Some Poultry Pests — C. F. H. Jenkins and G. D. Rimes	38
Cooling Milk on the Farm — H. M. Lister	49
Marketing of Vealer Carcasses	53
Vibriosis in Dairy Cattle — C. R. Toop	55
Light Land Development in the West Midlands — B. F. Carlin	59
Diseases of the Farrowing Sow — A. W. Williams	61
Manganese Deficiency in the Cereal-Growing Areas — S. T. Smith and W. J. Toms	65
Bacterial Canker of Stone Fruits — Olga M. Goss	73
Kikuyu Grass Planting by Machine — F. E. Ryan and J. A. Carberry	81
Feeding Stuffs for Livestock — L. C. Snook	85
Actinobacillosis ("Lumpy Jaw") in Sheep — F. C. Wilkinson	87
Poison Plants of Western Australia — C. A. Gardner	91
Some Points on Using Weed-Spraying Equipment — G. R. W. Meadly	93
Farm Planning—Fences and Soil Conservation — B. a'B. Marsh	97
Household Poultry-Keeping—Part 2 — R. H. Morris, R. Vagg and M. W. G. Critchell	101
The Cost and Value of Feeding Stuffs — L. C. Snook	117
A Method of Inoculating and Lime-Pelleting Leguminous Seeds — W. P. Cass Smith and Olga M. Goss	119
Some Recent Rural Radio Talks	123

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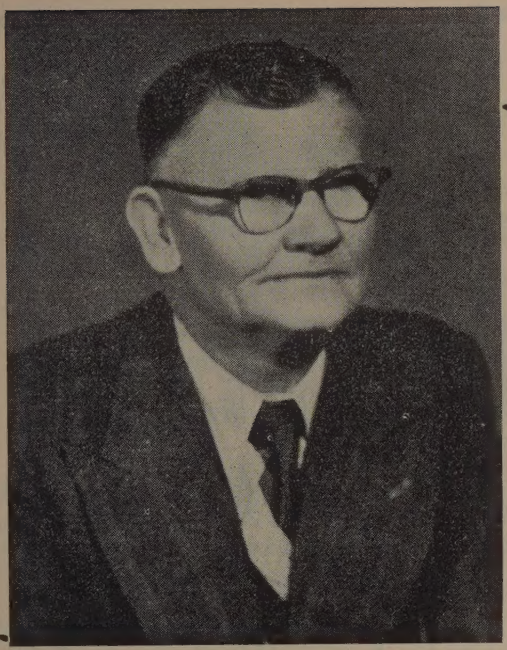

The Hon. L. F. Kelly, Minister for Agriculture, Lands and Fisheries.

New Minister for Agriculture

THE Hon. Lionel Francis Kelly, M.L.A., who became Minister for Lands and Agriculture in December, 1957, brings to his new post a wide knowledge of rural Western Australia and a wealth of experience in important Ministerial positions.

Formerly Minister for Mines, Industrial Development, and Fisheries, Mr. Kelly has now taken over the Lands and Agriculture portfolios relinquished by Mr. E. K. Hoar when he left for London as Agent-General for Western Australia. He had previously deputised for Mr. Hoar and has had personal experience of farming and stock-raising.

Born in Perth in 1896, Mr. Kelly was educated at Christian Brothers' College and managed a sheep station in the Gascoyne from 1915 to 1927. Between 1927 and 1944 he was storekeeping at Bullfinch and manager of the Sterling Gold Mines. He was one of the first men to raise sheep in the Bullfinch district and was Chairman of the Yilgarn Road Board from 1933 to 1941.

His Parliamentary career commenced in 1941 when he was elected to the Legislative Assembly as member for Yilgarn-Coolgardie. Later, with a change of electoral boundaries, he became member for Merredin-Yilgarn.

He achieved Cabinet rank in 1953 and as Minister for Mines and Industrial Development played a prominent role in the search for oil in Western Australia.

During a Government-sponsored visit to the United States of America in 1956, Mr. Kelly proved a worthy ambassador for his native State and made first-hand studies of the oil-drilling industry which should prove particularly valuable if oil is found in payable quantities in Western Australia.

Although Mr. Kelly has now relinquished the Mines and Industrial Development portfolios he still retains that of Fisheries in addition to Lands and Agriculture.

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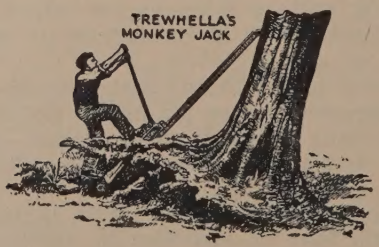


Grinding Shearing Combs and Cutters

How to achieve the best results

By M. BUTLER, Sheep and Wool Instructor,
and D. A. YOUNG, Shearing Instructor

BEFORE a high standard of workmanship in sheep shearing may be achieved it is imperative that the shearing equipment be maintained at the highest peak of efficiency, but, unfortunately, this is not always the case. Chief among the faults that occur at shearing time is the inefficient grinding of the combs and cutters, the most essential parts of the shearing machinery. If the combs and cutters will not cut, the efficiency of the whole shearing plant is affected. Badly-ground tools increase the work of the shearer, considerably reducing his daily output of sheep, and are the main reason why sheep kick and strain while being shorn, which tends towards poor shearing generally.

Poor grinding is more often the result of a lack of understanding of the principles of grinding, as once a knowledge of the grinding machinery is acquired, the grinding of the tools becomes simplified, better grinding is achieved, and a large amount of the work involved in shearing is eliminated.

MAKING THE DISCS

The first job in connection with grind ing is the preparation of the grinding discs. This calls for particular care to see that no foreign matter remains between the disc face and the emery cloth. The discs should be thoroughly cleaned by using a clean stiff brush (which should be kept for this purpose) and hot water to remove the old glue from the disc face, which is then allowed to dry by evaporation. This work is best done with the discs on a raised bench, face upwards, ready to take the emery cloth, the grades of which are, No. 40, or its equivalent for the comb disc and No. 80, or its equivalent for the cutter disc.

When the discs have thoroughly dried out, prepare the disc face by evenly painting on the glue and allow it to dry for five to ten minutes, while the emery cloth is prepared by painting the cloth side with glue.

When everything is in readiness, place the emery cloth face upwards on the disc exercising care that the overlap is distributed evenly around the edges, and carefully pat it onto the disc. When the paper has gripped firmly, tap out the washer cavity with a small ball-pene hammer, avoiding any damage to the spindle hole in the disc. The disc is now ready for clamping, which is done by placing the clamp on the disc, then holding both edges together with both hands. Turn the disc and clamp over and screw down tightly before putting it aside for setting, which takes from five to six hours.

When the glue has dried, and before releasing the clamp, trim the surplus emery from around the edge with a sharp knife.

Before assembling the disc on the grinder, it should be placed for ten minutes in the best drying place, care being taken to see that it is free from water or grease spots.

CLEANING THE COMBS AND CUTTERS

Before grinding, the combs and cutters should be washed, and dried with a cloth to avoid transferring grease or yolk to the disc face, taking care to see that the pin-holes are free of dirt. Any laxity in this regard will soon destroy the emery surface and bad grinding will result, also the emery cloth will need to be changed more frequently.

WHEN TOOLS NEED RE-GRINDING

When a comb has been used for some time, the cutting edges, particularly towards the points, become rounded. This dullness can be seen when the comb is held side-on in a good light, and appears as silveriness on the cutting edge of the teeth. Combs and cutters should be ground until this dullness completely disappears and is replaced by a keen sharp edge, but do not overgrind or overheat the tools.

CLEARANCE AND GRINDING GROOVES

Shearing combs have a groove across the face for the purpose of clearing the steel and emery particles ground from the lower part of the comb during the process of grinding. This is necessary to allow a new starting point for grinding the teeth of the comb and, in effect, the comb is ground in two separate sections in one operation. When the groove disappears as the comb wears, no clearing effect takes place and consequently the comb cannot be ground in a proper manner. The parts that are removed, or gulleted from the bottom of the comb are to reduce the lower grinding surface and balance the grinding areas above and below the "line of balance." If these parts were not gulleted out the comb would quickly grind away to the points.

THE LINE OF BALANCE

The "line of balance" (Fig. 1) is the line where the pendulum magnet exerts pressure on the comb when grinding takes place. This is governed by the position of

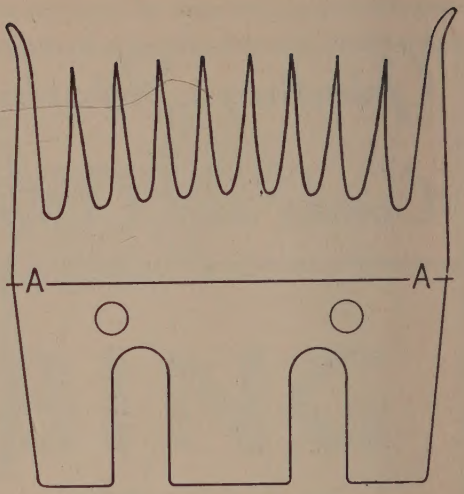


Fig 1.—The line of balance

the holding pins attached to the lower magnetic pole. These pins are so placed to allow the comb to grind slightly to the heel, which assists in protecting the points of the comb. With each successive grind, the comb will become more heel ground until the gullets in the comb start to grind out. As this occurs, the lower area will gradually increase, altering the balance of the comb, which will then grind more to the points and gradually revert to level. When the grind reaches the points the comb will have reached the limit of its usefulness and should be discarded.

THE GRINDING DISCS

The discs of the grinding machinery are slightly convex, and will grind a lengthwise concave, or hollow in the face of the comb. This hollow grind compensates for the pressure exerted on the comb, by the application of tension. When both comb and cutter are attached to the shearing handpiece and tension is applied to the cutter, the resultant pressure straightens the comb and allows the cutting surfaces of both comb and cutter to meet accurately along the full length of teeth.

GRINDER SPEED

The ideal speed at which the grinding discs should revolve is 2,500 r.p.m. This should, if possible, be checked with a revolution counter. Slower grinding speeds require heavier pressure when grinding,

which tend to overheat and burn the points of the tools, and could cause feathering of the cutting edges. When ordinary pressure is used with slow grinding speeds the tools will not be properly ground but only polished, and will not cut satisfactorily.

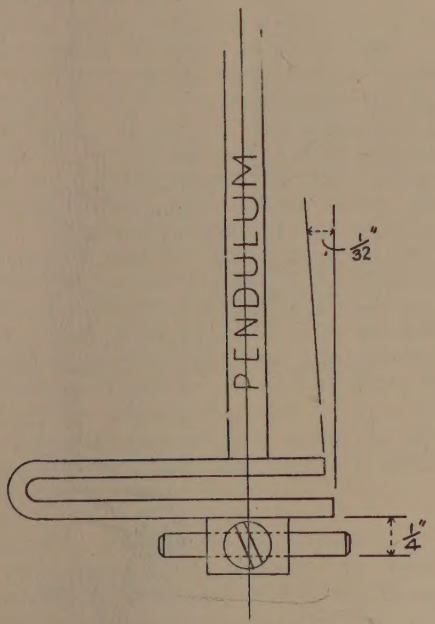


Fig. 2.—Magnetic holder

THE MAGNETIC HOLDER

Examination of the magnetic poles on the pendulum will reveal that the lower pole is slightly in advance of the top pole (see Fig. 2). The difference in the pole positions is to ensure that when a comb or cutter is placed on the magnetic holder for grinding, it will be drawn backward at the top, and the bottom of the comb, or cutter will strike the disc first, the comb leaving the top pole entirely as grinding commences. In this manner the points of the comb or cutter are protected from damage.

Further reference to Fig. 2 will show that the distance between the bottom of the lower pole of the magnet, to the bottom of the holding pins is $\frac{1}{4}$in.

This enables the lower pole, the one through which the pressure is applied, to take over the comb, or cutter at the "line of balance," which allows them to be ground correctly. It is most essential that the holding pins be accurately spaced from the lower magnetic pole, as any variation in the measurement, up or down, will seriously interfere with the grinding. Pins insufficiently spaced will exert the grinding pressure below the "line of balance" and difficulty will be experienced in making the grind reach the teeth of comb, while pins spaced over $\frac{1}{4}$in. will have the opposite effect and grind the combs and cutters excessively at the teeth.

Magnets and holding pins are set by the manufacturers and should not be altered. If alteration has occurred, by filing one or other of the magnets, or bending the pendulum rod, etc., correct adjustment should be made before grinding takes place. It is also advisable to check the holding pins to make sure that the comb will move freely when placed on them for grinding. If the pins are found to fit too tightly in the pinholes the diameter of the pins should be reduced.

ADJUSTING THE PENDULUM

The pendulum is hung on that side of the disc that rotates upwards, with the magnet suspended midway between the

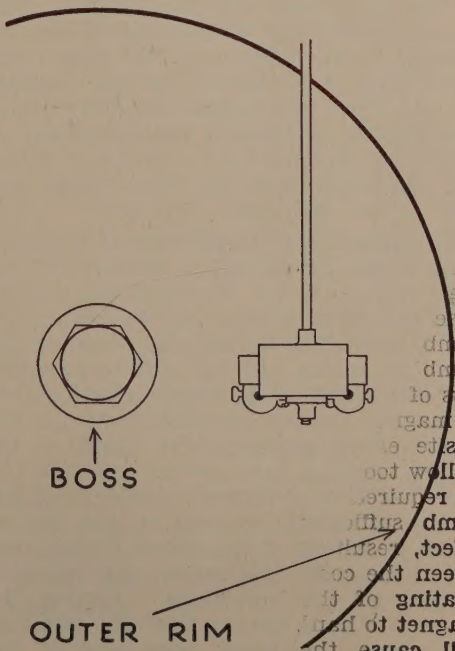


Fig. 3.—Correct pendulum adjustment

centre boss and the outer edge (see Fig. 3). When this position is found, adjust the magnet up or down by means of the thread

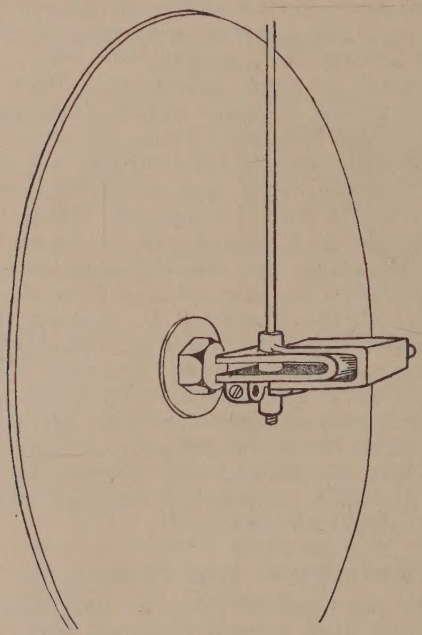


Fig. 4.—Correct height adjustment

on the pendulum rod, for height. The correct height will be indicated when the division between the magnetic poles coincides with the centre of the grinder spindle when the magnet is taken across. (see Fig. 4.) All that is now necessary, is to place a comb on the magnet and adjust the pendulum until the comb hangs just clear of the disc face. (Fig. 5.)

To explain the importance of correctly setting the pendulum, a magnet set too high will cause the depth of the lengthwise hollow to be ground too low in the comb face. This allows the teeth of the comb to spring too far with consequent loss of tension at the points of the cutter. A magnet set too low, will have the opposite effect, grinding the depth of the hollow too high, and excessive tension will be required to straighten the teeth of the comb sufficiently to achieve the desired effect, resulting in increased friction between the comb and cutter, and excessive heating of the handpiece. Setting the magnet to hang too far from the disc face will cause the lower edge only of the

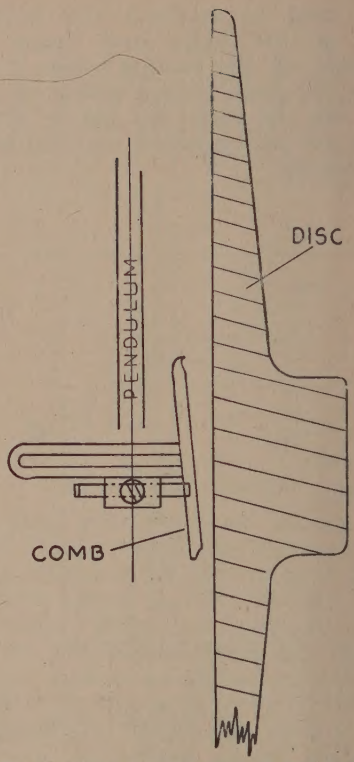


Fig. 5.—Comb hanging clear of disc face

bottom magnetic pole to exert pressure on the combs and cutters, grinding them excessively towards the heel.

GRINDING THE COMBS

Grinding shearing combs requires a little practice to gain that confidence necessary for success, and is carried out in the following manner. Stand facing the disc, at a position which allows free use of the elbows, and placing a comb on the magnetic holder take it to about one inch distant from the disc. Then, using both hands, with a quick movement apply the comb squarely on the disc face, moving it from side to side, pendulum fashion across the emery for about six seconds, **NOT LONGER.** This movement across the disc grinds the old face off the comb, but does not sharpen it. Repeat this process until all of the old face of the comb has been ground off, and the "silveriness" disappears from the cutting edges of the teeth. When the comb has been sufficiently ground, which may be determined by

holding it side-on in a good light, bring it to a position midway on the disc where the sparks leave straight up the teeth, and momentarily apply a slight extra pressure, observing that the sparks curl in towards the centre teeth of the comb. This movement will produce a good cutting edge and, at the same time, grind a hollow cross-wise in the centre of the comb, which minimises friction between the comb and cutter when in use.

The correct pressure to use can be determined by observing the height to which the sparks travel as they leave the disc. They should be made to reach just above the level of the top of the disc. The outer radius of the disc travels much faster than the inner radius, therefore, a compensating heavier pressure must be applied to the inner side of the magnet to ensure that the comb, or cutter grinds level. This pressure may be gauged by making the sparks from the inner side reach to the same height as they do on the outer side of the comb.

The free use of the arms is recommended when grinding, not the restricted use of the wrists only.

GRINDING CUTTERS

The cutters are ground on the fine emery (No. 80), and require much lighter pressure than the combs owing to the smaller area of steel presented to the face of the disc. Move the cutter across the disc the same as for the combs, but only for a few seconds, then momentarily hold the cutter stationary on the disc, where the sparks run straight up the teeth, then withdraw it. DO NOT exert a heavier pressure at the completion of the grind, as this practice will cause the cutting edges to become feathered, and possible danger of burning the points. Feathered edges will not cut cleanly but merely break the wool, while burning at the points will ruin the temper of the steel. The action of grinding the cutters should be the same for each cutter, so that even thickness is maintained for all the cutters during their useful life.

WORN EMERY CLOTH

It is useless to persist with grinding on worn emery cloth. When the emery becomes worn to such an extent that it will not grind the tools satisfactorily, it should be changed, as the resultant grind will not last for any length of time. Frequent changing of the emery cloth is essential for good grinding, as without good grinding, good shearing cannot be accomplished.

GOOD LIGHTING IMPORTANT

It is most important that grinding be carried out in a good light, so that the newly-ground edges may be thoroughly examined. When the grinding takes place in poor light, any dullness that remains cannot be seen and the tools may be underground, which will shorten their cutting life on the handpiece, and necessitate frequent changes.

The bulk of the sheep in the agricultural areas are shorn when the days are short and often cloudy. For this reason, the grinding of the tools should be carried out at midday when the light is at its best, rather than at the end of the day when the light is poor.

POINTS WORTH REMEMBERING

(1) Be sure to thoroughly clean the tools before grinding.
(2) See that the grinding discs revolve at the correct speed.
(3) Examine the magnetic holder before grinding commences.
(4) Make sure the magnetic holder is hung in the right position for correct grinding.
(5) Observe that the sparks leave the teeth of the combs and cutters to fly straight upward at the completion of the grind.
(6) Do not persist with worn emery cloth, change the paper frequently.
(7) Continue to grind the tools until the dullness disappears from the cutting edges.
(8) Always grind in a good light, and preferably at midday when grinding takes place only once a day.

COMB AND CUTTER COMBINATIONS

No matter how accurately the tools are ground, their cutting efficiency is impaired unless the correct combination of comb and cutter is used on the shearing

handpiece. Combs and cutters of different makes are available, the teeth spacing varying with most types. When the teeth spacing of the cutter does not correspond with the teeth spacing of the comb, the wrong combination is used and the resultant cut will be most unsatisfactory.

Correct combinations are those in which the teeth of the cutter accurately match the teeth of the comb, as illustrated in the centre diagram in (Fig. 6). The accompanying diagrams show the wrong combinations, left, a cutter that does not complete the cut, and right, a cutter with the teeth spacing too wide for the comb. Either of these combinations is wrong, and should not be used.

CUTTERS OF EVEN THICKNESS

To ensure that the cutting ability of the handpiece is maintained, it is most important that the cutters be of the same thickness, whatever the degree of wear. Cutters of different degrees of thickness will cause alteration to the post setting of the handpiece with every change of cutter. A useful method of keeping the cutters all the same size, is to bend a piece of wire to form the letter S. Thread the cutters on one end as they are reground, and use them from the other end when placing them on the handpiece. In this manner they will all receive the same amount of grinding, and will all remain even. When this is done, the centre post of the handpiece can be set to any one cutter and will be set for each of the cutters.

The importance of maintaining the cutters at a universal thickness cannot be over-emphasised.

THE SHEARING HANDPIECE

To obtain maximum efficiency, the speed of the handpiece should be maintained at not less than 3,200 revolutions. This may be checked by placing the revolution counter on the back cogs of the handpiece. Any reduction in speed will not only affect the cutting ability of the tools, but will have a tendency to make the handpiece feel lifeless in the shearer's hand, and will have a retarding effect on his ability to shear in a proper manner.

Fig. 7 is a diagram of the internal working parts of a shearing handpiece, alphabetically named. Some of these parts are subject to a good deal of pressure while the handpiece is in operation and should be inspected at frequent intervals for excessive wear, and replaced if necessary.

The main wearing parts are (H) Centre post (I) Fulcrum (C) Tension pin (D) Crown plate (B) Tension sleeve, and also (F) Fork yokes.

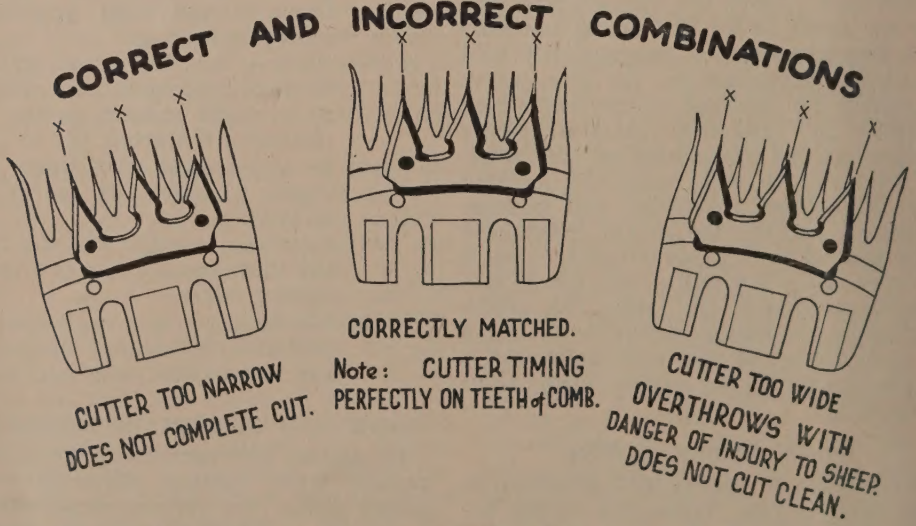


Fig. 6.—It is essential to have properly-matched combs and cutters

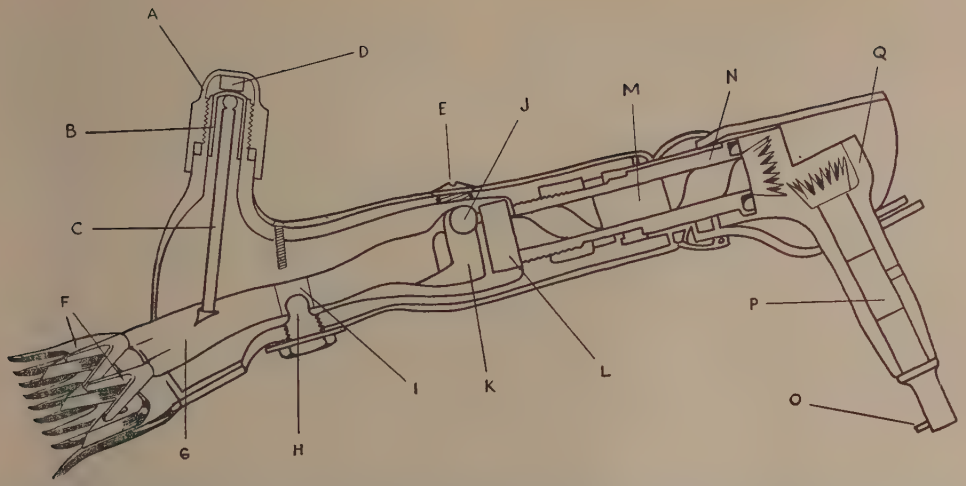


Fig. 7.—Shearing Handpiece—(A) Tension nut; (B) Tension sleeve; (C) Tension pin; (D) Crown plate; (E) Inspection screw; (F) Fork yokes; (G) Fork; (H) Post; (I) Fulcrum; (J) Ball; (K) Ball race; (L) Crank head; (M) Main spindle; (N) Bush; (O) Spindle pin; (P) Back spindle; (Q) Back joint

Excessive wear on the centre post (H) will be exhibited when the ball on which the fulcrum (I) seats, becomes "out of round," or egg-shaped. At this stage it has reached the limit of its efficiency and should be renewed. It is advisable, at the same time, to renew the fulcrum.

The tension pin (C) will, after much usage, become worn at both ends. This will shorten the pin and difficulty will be experienced in applying the correct degree of tension. As this become apparent, the tension pin, crown plate (D) and tension sleeve (B) should be renewed.

The fork yokes (F) should at all times fit snugly in their sockets, as any degree of slackness at these points will affect the accurate setting of the centre post and make it diffcult to achieve maximum efficiency in the handpiece. Also at this stage the points that fit the cutter pinholes will be sufficiently worn to effect their proper seating in the pinholes and replacement of the fork yokes will become necessary.

SETTING THE CENTRE POST

Before a handpiece is put into use, the centre post may need adjusting to the thickness of the cutters to be used. This is done by placing a comb and cutter on the handpiece, and then by releasing the lock-nut, the centre post can be raised or lowered, by means of the screw thread on the post, as required. The centre post will be correctly set when the ball (J)

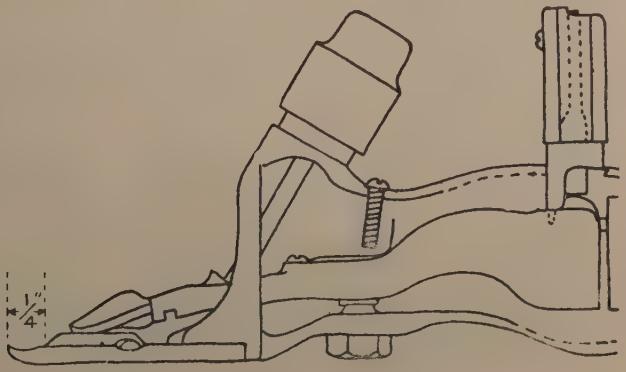


Fig. 8.—Testing the centre post

protrudes one-third from the ball race (K) both top and bottom. This can be tested by removing the inspection cap on top of the handpiece, and inserting a centre post gauge (Fig. 8.)

An important point to remember, is that when altering the height of the centre post, use a HALF TURN at a time, until the correct adjustment is made. One half-turn will bring the reverse, or unworn, side of the post into the seating in the fulcrum cup. Two half-turns will return the post to its original seating. DO NOT use quarter, or three-quarter turns, as this will give an uneven seating of the centre post in the fulcrum cup.

"LOADING THE HANDPIECE"

The term "loading the handpiece" means attaching a comb and cutter to handpiece. To do this correctly requires a litle care to see that the cutter does not throw over on one side of the comb (see Fig. 9), or it will not complete the cut on the opposite side. There is a slight

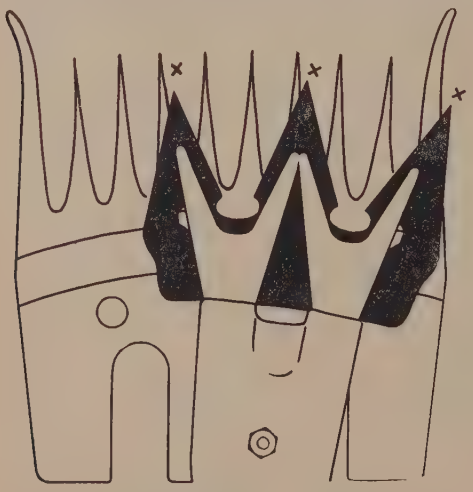


Fig. 9.—Cutter "throwing over" the bottom tooth

variable movement sideways to correct any tendency for the cutter to overthrow the comb, before the comb screws are tightened. At the same time, adjustment for "lead" is made. "Lead" is the distance the points of the comb are in advance of the points of the cutter, which should be not less than a quarter of an inch (Fig. 10). A lesser distance will allow the cutter points to override the combing bevels of the comb. A greater distance would necessitate holding the handpiece too flat when shearing, and would require extra effort in entering the comb into the wool. When using cutters that are new, or nearly new, the comb will need to be "stood up" or moved forward on the handpiece, leaving a space between the bottom of the comb and the back of the plate to which the comb is attached (see Fig. 11.)

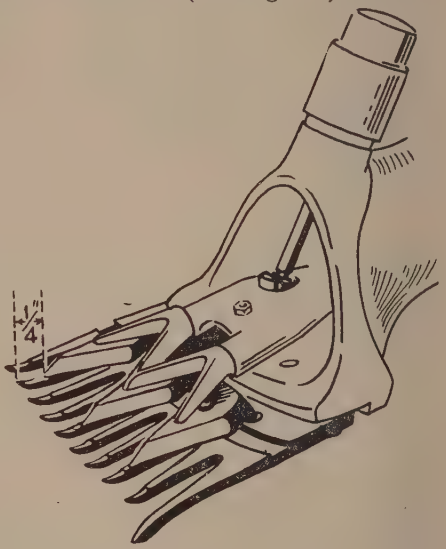


Fig. 10.—Correct comb lead

PRECAUTIONARY MEASURE

Prior to placing the handpiece on the downtube, it is advisable to check it for freedom of movement. This is carried out by applying a light tension on the cutter, then placing the right thumb on the driving cogs at the rear of the handpiece, rotate the spindle to make certain the cutter moves freely across the face of the comb. Failure to check the cutter for freedom of movement, can result in an accident if the handpiece should lock.

CORRECT TENSION

When the handpiece is set up for use, the right degree of tension can only be applied while the machine is running. It requires some experience to gauge, by feel, just what is the right degree of tension. Usually, when the handpiece exhibits a slight tendency to turn over when held loosely in the hand, the tension is near-correct and may require only slight ad-

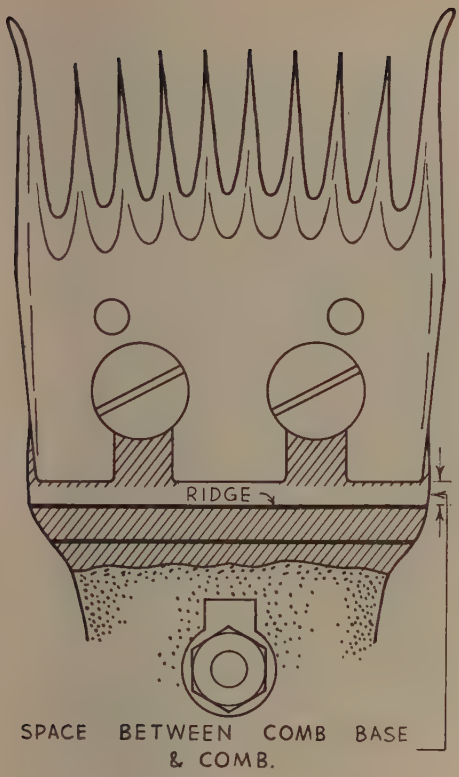


Fig. 11.—The comb "stood up"

justment either way. The correct tension, should be the lightest tension possible that will make the machine cut freely, and at the same time feel alive in the hand. Too much tension will cause overheating, with consequent expansion of the comb and cutter. This will cause smoke to rise, and will quickly ruin the cutting edges making frequent changes of the tools necessary.

EXCESSIVE USE OF TOOLS

It is unwise to persevere with combs and cutters that do not cut freely. The cutting edges have a limit to their usefulness before reaching the stage where they need to be replaced. It is advisable to use at least two, and sometimes three cutters to each comb. The amount of tools used will vary with the type of sheep, and the condition of the wool being shorn. In hard sandy sheep the tools will need to be changed more frequently, while in light free-cutting wool such frequent changes may not be necessary.

However, no matter which type of sheep is being shorn the cutting ability of the machinery must be at its best to avoid plucking, instead of cutting, the wool fibres. Plucking causes pain to the animal which makes it kick and strain.

LUBRICATION OF WEARING PARTS

Shearing machine oil is cheaper than replacements, and proper lubrication of all the working parts is essential. Without proper lubrication no machine can function perfectly. Always see that the barrel of the handpiece is filled with lubricant. Occasionally withdraw the chicken feet by turning them over with a pair of pliers and insert some grease in their holders before replacing them. Remove the coupling spring and fill the joint caps with grease from time to time, to save wear in the back joint. All other oiling points can be reached with the oil can. A good system is to first release the tension and oil the centre post and fulcrum cup making sure that the oil penetrates to these points. After re-applying the tension, drop a little oil on the comb and cutter, and with the handpiece turned over squirt some oil into the tension sleeve. Oil the ball and ball-race through the hole in the inspection plate, completing the job by oiling the back cogs and driving spindle.

IT DEFINITELY PAYS

To use the right combination of comb and cutter.

To keep the cutters all of the same thickness.

To see that the centre post is set correctly, using a post gauge.

To see that the cutter does not throw over the comb.

To have sufficient "lead" on the comb.

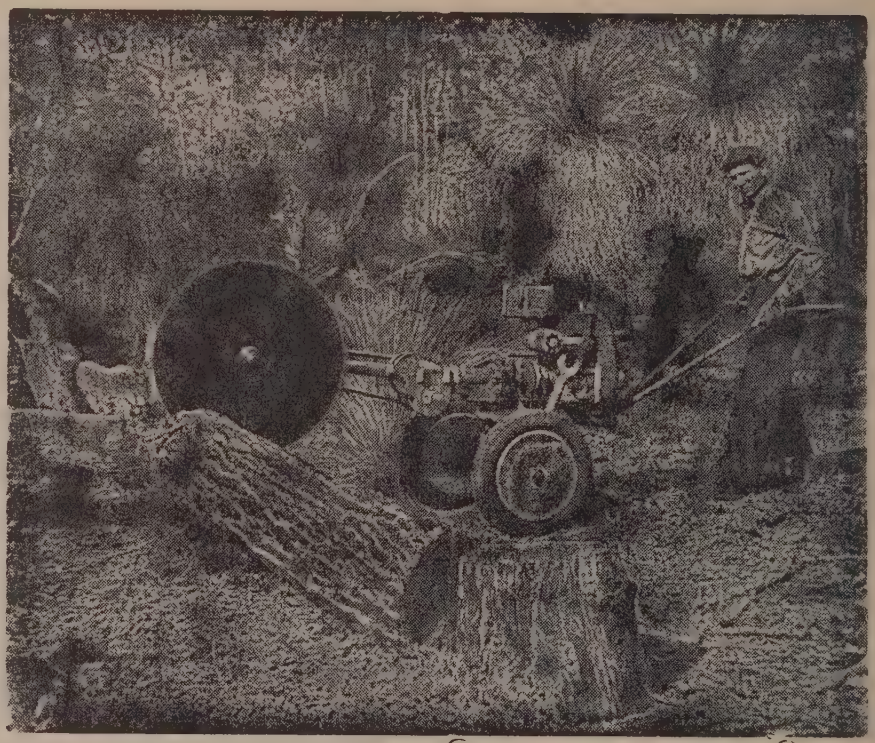
To check the handpiece for freedom of movement before attaching it to the downtube.

To refrain from using excessive tension.

To change the tools when the cutting edges have become dulled.

To occasionally insert some grease in the fork yoke seatings, and the thrust caps on the back joints of the handpiece.

To keep the machine well oiled.



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A TURKEY RAISING EXPERIMENT

By H. D. HESSELS, Technician, Poultry Branch

IN order to obtain some accurate information on the factors governing the profitable rearing of turkeys, an experiment was commenced at the Poultry Research Station, Leederville, on October 12, 1955, using 54 artificially-hatched day-old Bronze-wing poults, of which 29 were toms and 25 were hens.

The poults were sexed, and the toms and hens were brooded separately under two charcoal brooders for six weeks, after which they were kept in semi-intensive sheds, each provided with a spacious run containing natural greenfeed. The birds and the feed were weighed weekly.

FEEDING METHODS

The birds were fed on dry mash using three different rations—Ration 1 from day-old to 6 weeks; Ration 2 from 7 to 10 weeks, and Ration 3 from 11 to 32 weeks, at which age the birds were marketed.

The mashes—the compositions of which are described in detail in Table 1—were given ad lib. and freshly-cut greenfeed (clippings from a Kikuya grass lawn) was fed daily at an increasing rate until the birds each received 1½ oz. daily at 10 weeks, a quantity which was then maintained until the end of the experiment.

After the birds reached the age of 10 weeks they were given whole wheat grain with the intention of increasing the grain consumption to 40 per cent. of the total food intake and thus reducing the overall protein content of the ration to 16 per cent.

In practice, however, the birds would not consume sufficient wheat and it was not until they were over 24 weeks old that they reached the 40 per cent. grain intake.

Table 1
COMPOSITION OF MASHES

	Ration No. 1 (Up to 6 weeks)	Ration No. 2 (7 to 10 weeks)	Ration No. 3 (11 to 32 weeks)
	lb.	lb.	lb.
Bran	15	15	15
Pollard	10	10	10
Kibbled Wheat	50	50	50
Finely ground oats	10	10	10
Whale meal	20	10	10
Meat meal	13	11	11
Buttermilk Powder	6	....	....
Dried brewers yeast	2	....	....
Bone flour	2	2	2
	oz.	oz.	oz.
Common Salt	10	10	10
Commercial preparation of Amino-nitrothiazole (for prevention of Blackhead)	4	4	....
Commercial preparation of Aureomycin (Antibiotic)	grams 140	grams 140	....
Vitamin A and D_3 supplement at recommended level	....	Same as Ration 1	Same as Ration 1
Synthetic riboflavin at recommended level	....	Same as Ration 1	Same as Ration 1

THE ANALYSES OF THE MASHES WERE :

	Mash I	Mash II	Mash III
Crude protein (per cent.)	23·6	19·1	19·1
Phosporus (P) (per cent.)	1·2	1·4	1·4
Calcium (Ca) (per cent.)	2·5	2·0	2·0
Vitamin A (International units per lb. of feed)	2,623	3,125	3,125
Vitamin D_3 (International units per lb. of feed)	262	312	312

TOMS GREW MORE QUICKLY

The experiment showed that the toms gained weight more rapidly than the hens, and their conversion rate (the number of

pounds of feed required to produce 1 lb. gain in body weight) was better at every stage of the experiment.

Growth Rates.

Table 2 shows the average weights of the birds at four-weekly intervals.

Table 2

GROWTH RATES

Age in Weeks	Average Weight of toms	Average Weight of hens
	lb.	lb.
4	·6	·5
8	2·0	1·7
12	3·6	3·1
16	5·8	4·9
20	8·4	6·4
24	11·1	8·0
28	14·0	9·1
32	16·9	9·1

The toms weighed from 13.8 lb. to 24.4 lb. at 32 weeks. The majority (85 per cent.) weighed between 15.5 lb. and 17.5 lb., with 9 per cent. more than 17.5 and 6 per cent. less than 15.5 lb.

The weight range for the hens was from 6.8 lb. to 14.2 lb. The majority (89 per cent.) weighed between 8.5 lb. and 10 lb., with 5 per cent. more than 10 lb. and 6 per cent. less than 8.5 lb. The hens stopped growing at 30 weeks but the toms continued to gain weight throughout the experiment. The flock remained un-culled throughout the feeding period.

Conversion Rates.

Table 3 shows the conversion rates—the number of pounds of food required to produce 1 lb. of liveweight gain. It will be seen that at all stages of the trial the conversion rate of the toms was better than that of the hens—in other words, the toms ate less food to gain the same increase in liveweight.

Table 3

PROGRESSIVE CONVERSION RATES
(Pounds of food consumed to give 1 lb. increase in liveweight)

Age in Weeks	Toms	Hens
	lb.	lb.
4 .. .	3·3	4·6
8	3·4	3·7
12 ...	3·6	3·9
16 ..	3·5	3·8
20	3·5	4·1
24 ..	3·8	4·3
28	4·1	4·9
32	4·4	5·9

It will be seen that, after the age of 28 weeks, the hens showed a big increase in food consumption per lb. of liveweight gain. As previously mentioned, they ceased to grow at 30 weeks. In practice therefore it would be a good policy to market the hens at an earlier age than the toms—not later than 28 weeks.

COST OF PRODUCTION

For the purpose of this experiment, only three factors were taken into consideration when assessing the production costs. These were the original cost of the poults (6s. 3d. each, unsexed); brooding costs at 3d. per bird, and feed costs on the following basis:—

	Per lb.
Mash (Ration 1) at	5.1d.
Mash (Ration 2) at	4.7d.
Mash (Ration 3) at	3.5d.
Wheat (14s. 6d. per bushel) at	2.9d.

On this basis, the production cost per bird, also the cost of producing 1 lb. of liveweight gain, are given for toms and hens at four-weekly stages in Table 4.

Table 4

COST OF PRODUCTION

Age in Weeks	Cost per bird	Toms cost per lb. liveweight	Cost per bird	Hens Cost per lb. liveweight
	s. d.	s. d.	s. d.	s. d.
4	7 4	11 3	7 3	14 6
8	9 1	4 7	8 10	5 2
12	11 2	3 1	10 10	3 6
16	13 3	2 3	12 8	2 7
20	15 11	1 11	14 9	2 4
24	19 7	1 9	17 2	2 2
28	23 8	1 8	19 9	2 2
32	28 7	1 8	22 3	2 5

In actual practice, the production cost would be higher as it should include the costs of labour, depreciation, greenfeed, etc. These however would vary from farm to farm.

Loss of Birds.

Birds lost through death or other causes would also affect the production cost of the group. A commercial turkey-raiser

Table 5

TOMS: PROFIT OR LOSS PER BIRD IN RELATION TO AGE AND LIVEWEIGHT PRICES

Age of Bird	Average Weight of Bird	Mash Consumed	Grain Consumed	Cost of Food	Total cost per Bird Poult (6s. 3d.) Brooding (3d.) plus food cost	Return per bird at liveweight prices of 2s. to 5s. per lb.											
						At 2s.	At 2s. 3d.	At 2s. 6d.	At 2s. 9d.	At 3s.	At 3s. 3d.	At 3s. 6d.	At 3s. 9d.	At 4s.	At 4s. 3d.	At 4s. 6d.	At 4s. 9d.	At 5s.
	lb.	lb.	lb.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
12 weeks	3·6	11·6	·9	4 8	11 2	4 0*	3 1*	2 2*	2 2*	4*	6	1 5	2 4	3 3	4 2	5 0	5 11	6 10
16 weeks	5·8	18·4	1·3	6 9	13 3	1 8*	3 2*	1 3	2 8	4 2	5 7	7 1	8 6	9 11	12 5	13 10	15 4	16 9
20 weeks	6·4	27·3	1·7	9 5	15 11	10	3 0	5 1	7 2	9 3	11 5	13 6	15 7	17 8	19 9	21 11	24 0	26 1
24 weeks	11·1	38·8	2·9	13 1	19 7	2 7	5 4	8 2	10 11	13 9	16 6	19 3	22 0	24 10	27 7	30 4	33 2	35 11
28 weeks	14·0	48·8	8·5	17 2	23 8	4 4	7 10	11 4	14 10	18 4	21 10	25 4	28 10	32 4	35 10	39 4	42 10	46 4
32 weeks	16·9	59·9	15·1	22 1	28 7	5 3	9 5	13 8	17 11	22 1	26 4	30 7	34 10	39 0	43 3	47 6	51 8	55 11

Table 6

HENS: PROFIT OR LOSS PER BIRD IN RELATION TO AGE AND LIVEWEIGHT PRICES

12 weeks	3·1	10·8	·9	4 4	10 10	4 8*	3 10*	3 1*	2 4*	1 6*	9*							4 8
16 weeks	4·9	16·9	1·2	6 2	12 8	2 10*	1 8*	5*	10	2 0	3 3	4 6	5 9	6 11	8 2	9 5	10 7	11 10
20 weeks	6·4	23·8	1·7	8 3	14 9	1 11*	4*	1 3	2 9	4 5	6 1	7 8	9 3	10 10	12 5	14 1	15 8	17 3
24 weeks	8·0	31·0	2·9	10 8	17 2	1 2*	10	2 10	4 10	6 10	8 10	10 10	12 10	14 10	16 10	18 10	20 10	22 10
28 weeks	9·1	35·7	8·1	13 3	19 9	1 7*	9	3 0	5 3	7 7	9 10	12 1	14 4	16 8	18 11	21 2	23 6	25 9
32 weeks	9·1	40·5	12·7	15 9	22 3	4 1*	1 9	6	2 9	5 1	7 4	9 7	11 10	14 2	16 5	18 8	21 0	23 3

* Figures marked by asterisks show losses.

would be well-advised therefore to keep a record of the ages and sexes of birds lost so that by reference to the Cost of Production Table (Table 4) he can ascertain the cash loss on these birds.

For example, in this experiment, if a tom died or was stolen at the age of 24 weeks it would represent a loss of 19s. 7d. —a hen at 16 weeks would represent a loss of 12s. 8d., and so on.

The sum of these losses should be deducted from the total returns when calculating the net profits of the venture.

PROFIT IN RELATION TO AGE

The large tables (Tables 5 and 6) make it possible to ascertain the profit or loss per bird at various ages and at different prices per lb. liveweight.

The return per bird is calculated by multiplying the weight of the bird in pounds by the price per lb. liveweight.

Separate tables are given for toms and hens as the two sexes differed widely in food consumption, growth rates and conversion rates.

Although the hen carcasses were more attractive due to their compactness and better finish in this experiment, the toms were a much more profitable proposition.

For instance, the hens showed a profit of only 7s. 6d. per bird at 3s. per lb. liveweight when they were 28 weeks old.

The toms showed a profit of 9s. 3d. per bird at only 20 weeks or 18s. 4d. per bird if kept to 28 weeks.

In the case of the hens, they reached their maximum profitability at 28 weeks after which the profit margin diminished. The profit from the toms was still increasing at 32 weeks.

It must be emphasised that the returns per bird shown here are those which applied in this particular experiment and are based upon the growth rates and conversion rates of this particular group of birds. While we feel that they should provide a useful general guide, it must be realised that the profits obtained could vary if the growth and conversion rates differed from those obtained in the experiment.

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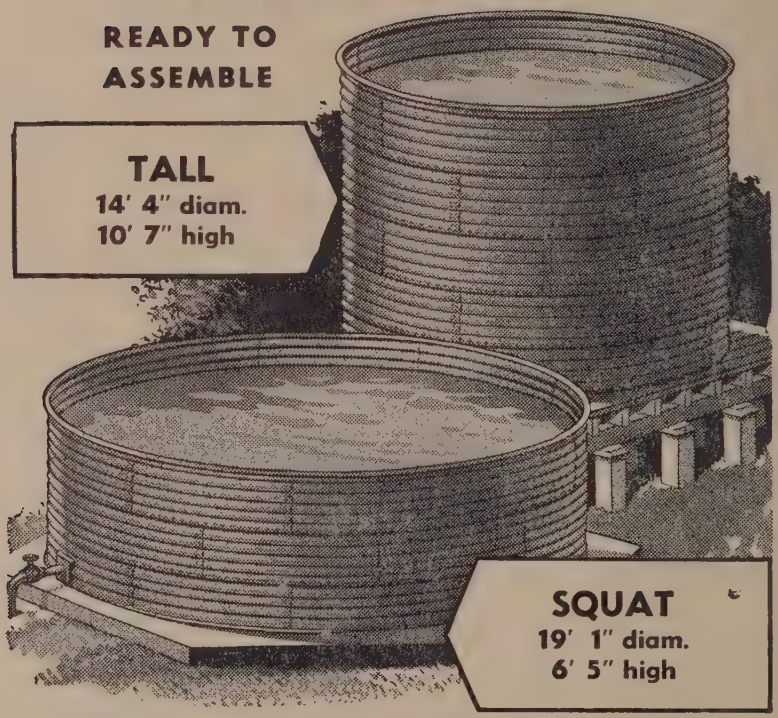

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Fig. 1.—Bare soil east of the Ord River. This particular patch extends 60 miles in a north-south direction, traversing sections of several East Kimberley stations

PASTURE REGENERATION IN EAST KIMBERLEY

By W. M. NUNN, B.Sc. (Agric.), Officer-in-Charge, North-West Branch

TRIALS established by officers of the North-West Branch to demonstrate methods of recovering eaten-out country under pastoral conditions, have met with considerable success and have been described in earlier issues of the Journal. This article tells of two particular Kimberley station projects which are noteworthy for two very different reasons.

1.—ORD RIVER STATION

In the upper catchment area of the Ord River in East Kimberley and extending into the Northern Territory, are perhaps the worst and most extensive of the northern areas subject to, or threatened by, soil erosion. On the main road between Argyle and Nicholson one can drive for 60 miles through country continuously bare of grass—the direct result of consistent overstocking with cattle. In very good seasons a little short-lived cover of annual species is obtained; in poor, or average seasons, there is nothing but bare soil throughout the year. Not only have the perennial grasses gone but the tree population has gone also—killed by the parched conditions resulting from the wholesale removal of ground cover.

These are rich black soils which should recover well given a chance. The back country in this region must have grass because the stations are still producing and the cattle still have the run of the bare areas which already are gullying quite severely in places.

Stations in West Kimberley have been taking a keen interest in departmental demonstrations at several points on the Fitzroy River but, until recently, no move had been made in East Kimberley.

In September, 1956, the initiative was taken by Agricultural Advisers, Kevin Fitzgerald and Joe Ritson, and a start was made on Ord River Station with assistance from Manager Bill Hamel.

The two Advisers, who normally work at separate ends of the Kimberley Division, pooled resources for this venture. They set

Fig. 2.—Department of Agriculture mobile plant en route to Ord River Station. Tractor and implements are on trailer towed by Land-rover

out with truck, tractor and trailer and a number of agricultural implements—much of the equipment was borrowed from Kimberley Research Station.

The trip involved nearly 200 miles each way for the outfit and three full days on the station for our two Advisers and their assistants—Geof Henley and Jim Broun. They worked from dawn till dusk because they had no lights to enable them to work longer, and left 350 acres of checker-board furrows. These were set out of course in an experimental design to check the comparative effectiveness, under these new conditions, of the several different agricultural implements under trial, and were sown to several pasture species.

The station responded by fencing the area and keeping stock off it.

The 1956-57 summer was a drought in this region so startling results could hardly be expected. Nevertheless there

Fig. 3.—Furrows at Ord River Station after the first season—a severe drought year. Some response is shown where "ponding" occurred at furrow intersections

Fig. 4.—This area was bare 12 months prior to this photograph being taken. Buffel grass has grown densely in the furrows. The intervening areas are covered with annual pigweed (*Portulaca* spp.) with buffel grass spreading through it

were encouraging responses, particularly at points where furrows intersected and extra soakage was obtained.

In August, 1957, a follow-up visit was made by the team. Intermediate furrows were made, closing the checkerboard designs from a 2 chain to a 1 chain grid.

In addition a further area of something over 1,000 acres was furrowed and planted on the contour and fenced from station stock.

Mr. Hamel is certainly keenly co-operative and his Company—Vesteys Ltd., is capable of tackling the job in a big way if we can convince them by these demonstrations that the recovery programme is practicable and economical.

2.—OPERATION COONANGOODIE

This time, the urge to broach a particular project comes not from a feeling of need, but from one of real satisfaction that on Cherrabun Station at least the recovery processes are really under way.

Cherrabun is one of three stations in the Fitzroy Crossing area controlled by Emanuel Bros., and like a great many cattle stations has been badly eaten-out by continuous heavy stocking on the favoured areas near the river.

Fig. 5.—This photograph, taken on the Margaret River frontage of Gogo Station in May 1956, shows good growth of sown grasses (mainly buffel) in the furrows

Thousands of acres of the once beautiful grass plains of which Alexander Forrest and others wrote so glowingly, are now bare as a board for most of the year and the cattle still graze them.

Emanuel Bros., by the way, unlike a lot of others, admit the truth of this. It was unavoidable of course in earlier years with only the river pools available as watering points. Cattle thrived and multiplied. Numbers were higher in the early years of this century than they are now, but only a fraction of the country now in use was available at that time.

The company has followed an energetic programme of boring for some years to provide waters on the back country, but this had little effect in re-grassing the frontage. The way here has been shown by Agricultural Adviser Fitzgerald's trials on Gogo and Cherrabun.

Bare frontage soils furrowed and sown to buffel and Birdwood grasses and Kapok bush, and fenced off from grazing stock, have shown remarkable response. The initial trial of 100-odd acres on Gogo, gave such good establishment that Cherrabun's manager, Harry Scrivener, fenced in 1,000 acres and furrowed and spelled the lot.

This also succeeded despite comparatively poor seasons, and now "the game is really on." "Operation Coonangoodie," as Harry Scrivener has called it, is this year's reclamation programme, and involves the fencing and furrowing of the Coonangoodie plain which extends over 200 square miles which is quite a slice of country. To put it into farming language, it is 128,000 acres, or approximately 64 fair-sized wheat farms.

This area is to be enclosed, which means 40 miles of cattle-proof fencing; three flowing bores have to be fenced off; three new bores completed to water the cattle which must be moved farther south, and the enclosed area is to be furrowed and sown, in the first instance, at 5-chain intervals.

Later, if warranted, intermediate furrows will be made, reducing the interval to 2½ chains.

The Department of Agriculture has planned this approach and our demonstration tractor unit goes in as part of the team. Records and costs will of course be kept to evaluate results.

Fig. 6.—Single-furrow mouldboard ploughing on Cherrabun Station. It was photographed after early summer rain

As a commercial scale response to small-scale demonstration commenced only two seasons ago, this is really an impressive show. Emanuel Bros. have gathered fencing materials from their other stations; have purchased additional agricultural equipment, and three tractor outfits will be working night and day on the project for a period of weeks.

Forty miles of fencing is a large order and seems the most difficult part of the programme. Quite apart from the cost, its completion within the period to keep stock off the newly planted area during the first two seasons presents a labour and management problem of some magnitude. However, Emanuels are determined, and Harry Scrivener says the cattle will be kept off the planted area by men on horseback if the fences are not ready in time.

It is difficult to imagine a more heartening response to a departmental demonstration plot which started just two years ago.

The Sauce is so Important

By MARGARET SPENCER

HOT dishes are "tops" at parties these days, and to the party giver a quantity of well-made white sauce gives a good start to the quick and easy preparation of very many really delicious dishes which are sure to be "flavour favourites." Don't restrict their use to parties—the family will love them for luncheon and of course a lot of left-overs can be dressed up and made welcome on the meal table by the use of the sauce in one of its many forms.

With a few suggestions as a guide, let your imagination run riot. It can be fun!

BASIC WHITE SAUCE

Ingredients.

2 oz. butter.
2oz. plain flour.
1 pint liquid (milk or stock).
Salt and pepper.

Method.

Heat the butter in a saucepan till just melted. Sift in the flour and stir till smooth. Stir over fire till it is frothy (like honeycomb). Do not brown.

Remove from heat and add liquid gradually stirring well and cooking after each addition. When all liquid has been added cook till it has boiled three minutes. Add seasoning.

The sauce should be smooth and glossy.

The above proportions give a "coating" consistency.

For a thinner, "pouring" sauce use 1½ oz. of butter and 1½ oz. flour to 1 pint liquid.

VARIATIONS

Apart from the commonly-used parsley there are many additions which may add interest to this sauce.

Anchovy Sauce (delicious with steamed fish). To ½ pint sauce add 1 teaspoon anchovy essence.

Caper Sauce (served with boiled mutton). To ½ pint sauce add 1 tablespoon chopped capers and 1 tablespoon caper vinegar.

Onion Sauce (with boiled mutton, or poured over cold cooked lamb and sprinkled with cheese, then browned). To ½ pint sauce add 3 tablespoons chopped cooked onion. Or mix sauce with an equal quantity of onion puree.

Cheese Sauce (served with cauliflower, fish; used in salmon mornay, etc.). To ½ pint sauce add 2 tablespoons of grated cheese and a little mixed mustard.

Sweet Sauces.—Omit salt and pepper and add sugar and flavourings as desired.

SAVOURY SWEET CORN

Make ½ pint cheese sauce.
Add—1 large tin sweetcorn.
1 teaspoon lemon juice.
Grated rind of ½ lemon.
½ teaspoon mace or nutmeg.
Heat thoroughly, stirring well.
Pour into a heated ovenware dish.
Grate cheese over top. Brown in hot oven or under griller.
Garnish with rolls of grilled bacon and sprigs of parsley.

VEGETABLE MORNAY

Ingredients.

1 carrot, 1 parsnip, 1 small potato, piece of leek or white onion, small piece of celery (or any selection of suitable vegetables).
¾ lb. peas.
2 or 3 tomatoes.
1 teaspoon finely chopped parsley.
Pinch of mace.
Basic cheese sauce using 1 oz. butter 1 oz. flour ¼ pint milk (the stock from the vegetables will be added).
Salt and pepper.
Cheese to grate over top.

Method.

Scrape or peel vegetables and cut into small dice.
Cook in boiling salted water till just tender.
Cook peas separately with a little sugar and mint added.
Line an ovenware dish with sliced, skinned tomatoes. Sprinkle with salt and pepper. Add 1 or 2 tablespoons water. Bake in oven. Make sauce.
Strain cooked vegetables. Add sufficient of the liquid to the sauce to form a coating consistency.
Add vegetables, keeping back nearly all peas, and parsley.
Turn into ovenware dish without disturbing tomatoes.
Grate cheese over.
Brown in very hot oven or under grill.
Serve with a border of cooked peas.
(Any "left-over" cooked vegetables may be used in this dish).

ASPARAGUS IN SAUCE

Make a pouring sauce using the liquid from the cooked asparagus (a little water may be needed).
Add 1 dessertspoon lemon juice.
Grated lemon rind, salt, nutmeg.
Sliced gherkin.
Chopped hard boiled egg.
Pour over asparagus.
Serve very hot with fingers or triangles of toasted bread.
(Note—It is not necessary to make a large quantity of sauce. Avoid diluting the asparagus juice too much.)

CAULIFLOWER AU GRATIN

1 cauliflower.
½ pint cheese sauce.
Extra cheese.
Soak and wash cauliflower. It may be left whole, or be broken into small pieces.
Cook in boiling salted water till just tender and not discoloured or broken.
Place flower side up in ovenware dish.
Pour sauce over top and sprinkle with grated cheese.
Brown the top.
Garnish with parsley.

HOUSEHOLD HINTS

PLAIN silver that has been neglected and become tarnished may be very simply cleaned using aluminium foil and bicarbonate of soda. Egg spoons which have not been washed soon after use and have discoloured (due to the presence of sulphur in the egg) respond to this treatment.

Place a large piece of aluminium foil in the bottom of an old enamel saucepan. Add water (enough to cover silver to be cleaned) and 1 tablespoon of bicarbonate of soda to each quart of water.
Bring to boil. Remove from heat.

Immerse the silver and leave to stand for a few minutes.

Remove, rinse, and dry silver. Polish with a soft cloth or chamois.

N.B.—Do not use this method on silver with an oxidised pattern.

ADD SPARKLE TO CRYSTAL

Bicarbonate of soda is useful in cleaning glass or china vases and ornaments too. Rub the article with a cloth dipped in a solution of 3 tablespoons of soda to 1 quart of warm water. (A brush may be used on deeply cut pieces.) Then rub with a cloth dipped in clean warm water. Dry.

CLEAN OVENWARE EASILY

Stubborn marks on ovenware glass and china will respond to rubbing with a damp cloth dipped in baking soda, or put 2 to 3 tablespoons of soda in the dish and fill with hot water. Leave a few minutes then wash and dry.

A WRAPPING WITH POSSIBILITIES

The aluminium foil mentioned earlier has a lot of other uses too. If you go in for home freezing you will find it invaluable for wrapping foods to be frozen, and if you want to make sandwiches a day ahead for parties or lunch boxes you need have no fear of them becoming dry if you wrap them in the aluminium foil and store them in the refrigerator.

As it is not affected by oven temperatures it has many possibilities in cooking too.

Stuffed apples to be baked may be wrapped in it to retain all the juice and flavour.

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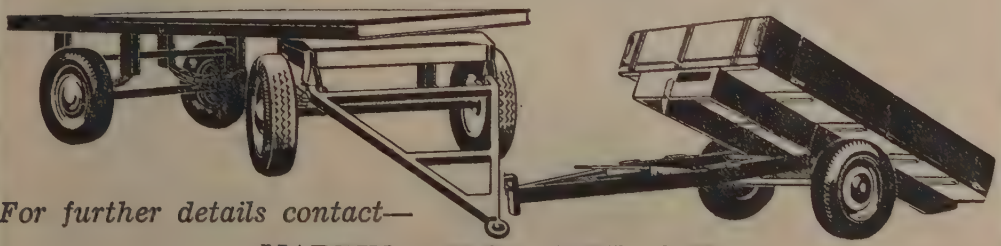

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STINKWORT

(*Inula graveolens* Desf.)

The characteristic smell of Stinkwort, due to a volatile oil, is evident in many parts of the State during the summer months. The barbed hairs attached to the seeds can penetrate the stomach lining of animals, causing conditions favourable for enterotoxaemia.

WEEDS of Western Australia

By **G.R.W. MEADLY** M. Sc.
Officer in Charge, Weeds and Seeds Branch

STINKWORT

(Inula graveolens Desf.)

THE original home of Stinkwort is the Mediterranean region, including northern France. Apparently the first Australian record was at Onkaparinga in South Australia about 90 years ago. Efforts were made to keep it in bounds during the years immediately following introduction, but it continued to spread and is now firmly established in all agricultural districts of South Australia. It also covers large tracts of land in New South Wales and Victoria and occurs in most districts of Western Australia.

During the summer months Stinkwort is green when much of the other vegetation is dry and straw-coloured. From a distance it often gives the impression of a succulent summer crop but has a low nutritive value, and is not relished by stock.

DESCRIPTION

Stinkwort owes its popular name to the presence of a volatile oil having a strong and characteristic odour. This is secreted by the small glandular hairs present in all parts of the plant. Dust and other light particles adhere readily to the sticky surface of the leaves.

It is a herbaceous annual 1-2 feet in height. The stem is erect, with many spreading leafy branches. The lower leaves are oblong lance-shaped with small teeth, the upper ones narrow and entire. The flowering heads are small and very numerous, in long, loose pyramid-like panicles. The yellow flowers are surrounded by narrow sticky bracts. The achenes ("seeds") are almost cylindrical, downy, narrowed into a neck at the summit, the pappus bristles appearing simple to the naked eye.

SIGNIFICANCE

Stinkwort is widely distributed in Western Australia. It grows during the late spring and summer, particularly in moist places, and is most vigorous on fallow where moisture has been conserved. Although some farmers claim that it is quite useful forage, this is not the generally accepted view. It can be a troublesome weed of summer crops and pastures, particularly during the establishment of plants such as lucerne.

The wool of sheep pastured on Stinkwort country is often discoloured by contact with the sticky foliage. Fortunately the stain is not permanent, being removed during scouring, and does not depreciate the value of the wool. Milk and butter have been tainted following the ingestion of Stinkwort by dairy cows and it is also claimed that the flavour of mutton can be affected if the weed is grazed by sheep.

The possible toxicity of Stinkwort remained a puzzle for many years. Losses

STINKWORT

(Inula graveolens Desf.)

A.—Plant showing abundant flower heads and fine rooting system. B. and C.—Leaves. D.—Flower heads. E.—Achene (seed)

(From a pen-drawing by the Government Botanist, Mr. C. A. Gardner)

of stock were often associated with grazing in paddocks containing quantities of the weed, but analyses of the plant failed to disclose the presence of any toxic principle, and both feeding and drenching tests with sheep gave negative results.

Most of the trouble has been experienced during the latter parts of the summer when the plants are seeding freely and other feed is often scarce. The serious effects have now been shown to be due to the irritation and penetration of the bowel lining by the barbed pappus hairs attached to the seed. These often remain embedded and the resultant injury provides conditions which are favourable for the rapid multiplication and toxin production of the enterotoxaemia or "braxy-like disease" bacterium. The absorption of this bacterial toxin can cause death, and Stinkwort, therefore, although not toxic in itself, may cause a condition which predisposes the disease.

A form of dermatitis has been attributed to handling Stinkwort particularly when in flower, and the effects have lasted for weeks or even months.

CONTROL

Small infestations can be handled by pulling or hoeing but in most localities Stinkwort is too widespread for this method to be practicable. Some degree of control results from heavy grazing when the plants are small. Cultivation to prevent seed formation is also carried out but often, during the summer, soils are too hard to plough and furthermore, workings increase erosion hazards. Mowing at the early flowering stage is helpful but cannot be expected to prevent all plants from seeding.

Stinkwort is not highly susceptible to the hormone-like herbicides but can be controlled by spraying with 2,4-D ester at the rate of 1-2 lb. acid equivalent per acre. The lower rate is effective when the plants are small but when larger, 2 lb. is recommended. Patches can be spot-sprayed using a knapsack or hand lead from a power unit. With this method 100 gallons of solution per acre is convenient. For more extensive infestations a low volume boom unit is desirable, applying the solution at 6-10 gallons per acre.

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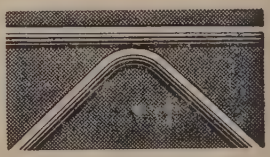

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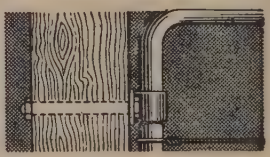

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INSECT Pests AND THEIR CONTROL

By C. F. H. JENKINS, M.A., Government Entomologist, and
G. D. RIMES, B.Sc., Entomologist

SOME POULTRY PESTS

THE poultry industry is an important source of revenue to many people in this State. During the season 1955-56, the value of eggs received at all Egg Board grading floors was £1,348,995. It is thus evident that any pests which adversely affect the domestic fowl are worthy of careful consideration.

Fowl parasites may be divided into two main types—internal parasites and external parasites. It is only the latter which concerns the entomologist. There are a large number of insects, ticks and mites which may be associated with birds, some permanently and others intermittently. Most bird species have their own parasite fauna and many interesting problems of adaptation and relationship have been shown to be associated with this specialisation, but such matters are beyond the scope of the present article.

As is so often the case with pests of domestic animals, fowl parasites are now practically cosmopolitan in distribution. There are two main groups to be considered—the ticks and mites and the true insects including lice, fleas, etc.

Ticks and mites in their adult condition possess four pairs of legs, and so can be distinguished from insects which of course only have six legs, but for practical purposes the former are often grouped with insects under the heading "Insect Pests of Poultry."

THE FOWL TICK

Argus persicus (Oken).

The first record of this pest in Western Australia was made in 1897 at Northam, and since then it has spread throughout the warm and dry parts of the State. The effects of fowl tick on the birds are often severe to the point of death. The ticks cause the birds discomfort at night by loss of sleep, but a more serious result of their activity is the loss of blood by the bird, and the possible introduction of the parasite causing the disease known as "tick fever." Young chickens are usually most seriously affected.

Symptoms of "tick fever."—The bird shows a loss of appetite, a rise in temperature, restlessness, blackness and shrinkage of the comb, and diarrhoea followed by paralysis and often death. Those fowls that recover have a degree of immunity from further attacks of the parasite.

Hosts.—Hosts of fowl tick include the domestic fowl, ducks, geese, turkeys, pigeons, ostriches, canaries, wild birds and somethimes cattle.

Fig. 1.—The Fowl Tick: Adult Female, upper and lower sides (enlarged)
(From U.S. Dept. Agric.)

Description.—The fowl tick is an oval, rather flattened creature, one-quarter to one-third of an inch long, without eyes, and with colour varying from light reddish brown to dark brown, depending on the amount of blood it has engorged. It has piercing and sucking mouth parts.

Habits and Life History.—In habits it is very similar and in appearance not unlike the common bed bug. It is essentially a night feeder, hiding in cracks and crevices during the daylight hours. Only the small six-legged "seed" ticks are found attached to the birds during the day as well as at night. As this period of their life is of short duration (5-10 days) it shows how easily an infestation can escape notice and puzzle anyone who finds birds unthrifty and yet carrying no parasites on them during the day.

The adult female tick lays eggs in batches of 50-100, and there are usually several layings totalling 500-900 eggs. These are brownish in colour, spherical and about 1/40th inch in diameter. They are usually laid in sheltered positions such as the cracks of perches and between pieces of wood used in the construction of the fowl house. These eggs hatch in from 2-4 weeks into six-legged "seed" tick which migrate during the night to the bird and attach themselves. The most favoured places of attachment are the breasts, thighs and under the wings. The "seed" ticks remain here for from 3½-10 days and engorge a large quantity of blood which is to last them over the next stage of their life. At the end of the feeding period, they are 1/10th inch long and drop from the birds to the ground. They then crawl into cracks, and after a week moult and emerge as eight-legged ticks in every way resembling the adult except in size. These small ticks only feed at night and return to the cracks in the daytime. They moult several times, each time increasing in size until they become adult. The period between the hatching of the egg and attainment of maturity is, under ideal conditions, about five weeks, but it may take considerably longer, as the tick can survive in any stage for long periods without feeding. "Seed" ticks may endure a fast for 5½ months, and adults have been known to survive four years of starvation. This fact is important in controlling this pest, as it is useless to try to starve it out and dangerous to take timber from old, long disused fowl houses for the construction of new ones.

The bark of trees also forms a good hiding place for ticks, especially in cases where unbarked bush timber is used for building purposes, or where birds roost in trees. Also, ticks will travel considerable distances along fences to other fowl houses. The eggs may be carried on old crates, etc.

Control.

Precautionary Measures.—The old proverb "prevention is better than cure" is especially appropriate when dealing with pests. If one erects a building which offers little protection to ticks, an accidental infestation may be easily eradicated. The houses should be built with new timber or with material obtained from clean premises, and if bush timber is used it should be secured from an area to which tick infested birds have not had access. Any cracks should be painted with tar, and suspended perches should be used wherever possible. Sheds constructed of angle iron and galvanised iron offer a minimum of harbourage to the pests but the initial outlay is high.

Finally, quarantine newly bought fowls in coops to make sure that they are tick free, particularly in the case of male birds.

Two weeks' quarantine is advocated.

Treatment of Premises.

If the structure in question is of little value it is wise to burn the complete henhouse and rebuild on a different site. If the structure is to be treated, nesting boxes, litter, straw, timber, etc., which the birds come in contact with must be burnt.

An application of 3 per cent. malathion spray to the structural portions of the poultry house will effectively control fowl tick infestations. Adult ticks and larvae are killed as they emerge to feed, and seed ticks are killed when they leave the birds. The sprays should be applied to the outside and inside of the henhouse, timbers, joists, etc., being thoroughly wetted.

Malathion as well as being effective on fowl tick will also control red mite. It also has an effect on the chicken body louse.

A thorough spraying with 2 per cent. aldrin emulsion to all parts of the henhouse will give a good control.

THE POULTRY MITE

Dermanyssus gallinae (Deg.).

Commonly called the red mite, this is a cosmopolitan pest of poultry and thrives under a wider range of conditions than the fowl tick, which has a distinct preference for warm surroundings. The mite attacks adult poultry as severely as young chickens. As with the tick, it normally feeds on the birds at night, leaving them during the day to return to the cracks and crevices of the perches, walls and surrounding woodwork of the pens or nest boxes. They have a habit of congregating

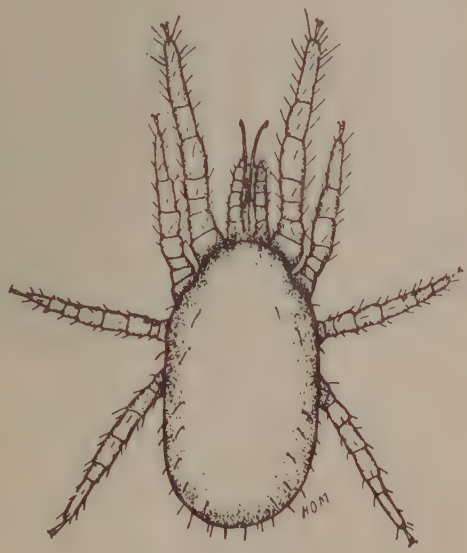

Fig. 2.—Poultry Mite (enlarged)
(After Mönnig)

in groups and it is not uncommon to find swarms of them under the roosts or to find them attacking a sitting hen in the daylight, but generally they leave the bird when they have engorged enough blood. The results of their attack may be fourfold:—

(1) They may cause great reduction in egg production.

(2) By constant feeding and irritation of the skin of the birds they may cause sitting hens to leave their nests, and even die.

(3) In severe cases they may cause great loss of flesh, unthriftiness, and reduction of vitality.

(4) They may transmit poultry diseases from infected birds to healthy ones.

Hosts.—The hosts of the poultry mite include pigeons, fowls, turkeys, pheasants and occasionally domesticated animals, and man himself.

Fig. 3.—Old roost, showing excreta following mite infestation
(From U.S. Dept. Agric.)

Description.—The mite is a small pear-shaped, grey to red creature measuring 1/30th to 1/40th of an inch in length with eight legs and piercing-sucking mouth parts. They are not easily seen individually, but their habit of congregating together makes them noticeable.

Life History.—The adult female lays her tiny white, shiny, oval eggs in her daylight haunts, i.e., the cracks and crevices of perches, nest boxes, etc. The eggs hatch in from 2-6 days, depending on the temperature, and a small six-legged mite emerges. The latter begins to feed, and after several engorgements, sheds its skin and becomes an eight-legged mite resembling an adult except for size. After several more engorgements of blood and subsequent moults, it becomes mature. This development takes from 1-2 weeks, but depends largely on the temperature, the parasites being relatively inactive in cold weather.

In the absence of a host the adult mites can remain alive in infested houses for four to five months.

Control.—The control measures for this pest are directed chiefly at the hiding places and the same control measures as for the fowl tick may be adopted. One should be wary of old timber, etc., when constructing fowl houses, and also isolate any introduced bird for some days.

When infestation has been noticed all litter, spare boxes, etc., should be removed and burnt. Roosts and nest boxes should be removed to facilitate spraying, and replaced by something more suitable to future clean-ups if necessary. When the house has been swept out it should be sprayed thoroughly under good pressure with one of the following:—

The red mite can be successfully controlled with a 1 per cent. lindane spray. A liberal application should be applied to all wooden parts of the structure, after the birds have been removed and the house thoroughly cleaned out. The birds should be kept out until the fluid has thoroughly soaked into the wood.

A thorough spraying with a 3 per cent. malathion emulsion will give good control of the pest. A thorough application to all parts of the structure is essential.

Aramite can also be used to control mites. One pound of 15 per cent. wettable powder to 100 gallons of water makes the required spray. It can also be used in the form of a 3 per cent. dust. It is relatively safe to both operators and birds.

Although not as effective as the above treatments, the use of black leaf 40 is still effective in light infestations. Run undiluted black leaf 40, at the rate of ½ ounce per 100ft., along perches half an hour before the fowls go to roost.

SCALY-LEG MITE

Cnemidocoptes mutans (Robin & Lanq.).

This is another mite which is not an uncommon pest in poultry. The general symptoms are a thickening of the legs on the scaly potrions due to the burrowing of the mites into the skin. This causes the scales to protrude and exudation to take place, which cakes on the outside. The infection generally starts on the toes and spreads upwards. Scaly-leg is very readily transmitted from bird to bird.

Hosts.—Common hosts of the scaly-leg mite are domestic fowls, turkeys, pheasants, pigeons and cage birds.

Fig. 4.—Healthy shank and foot of fowl
(From Jour. Agr. Victoria)

Description.—The adult mite which measures about 1/80th of an inch in length burrows into and lives in the skin. The female deposits her eggs in this position and on hatching, the young mites migrate to set up fresh colonies of infestation on the same bird, or on other birds which may be reached per medium of the perches.

Fig. 5.—Shank and foot of fowl affected with scaly-leg mite
(From Jour. Agr. Victoria)

Fig. 6.—Scaly-leg mite
(After Mönnig)

Control.—Soak the legs in warm soapy water and scrub with a hard brush. After this apply an ointment of lard to which has been added some sulphur and kerosene (seven parts lard to three parts

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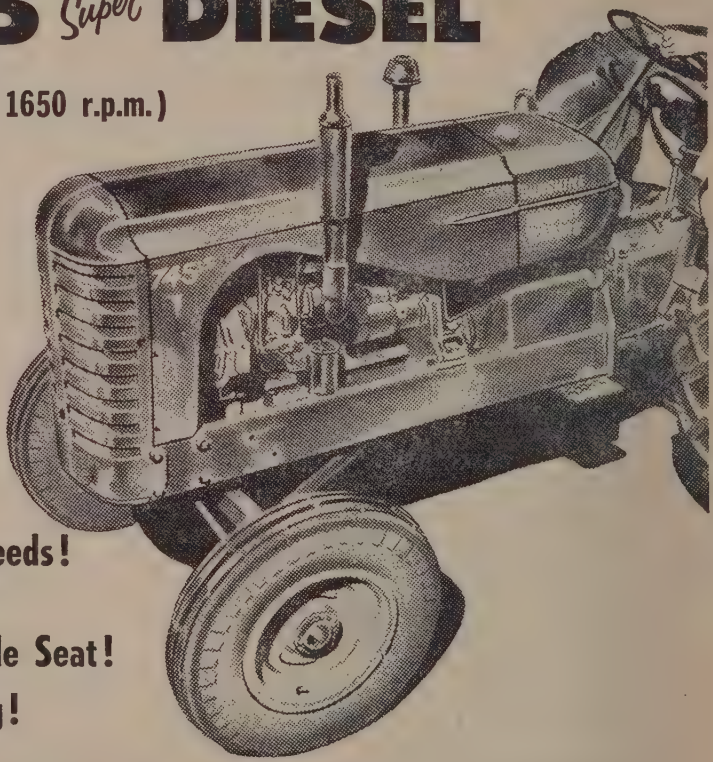

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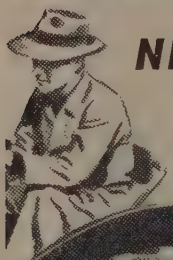

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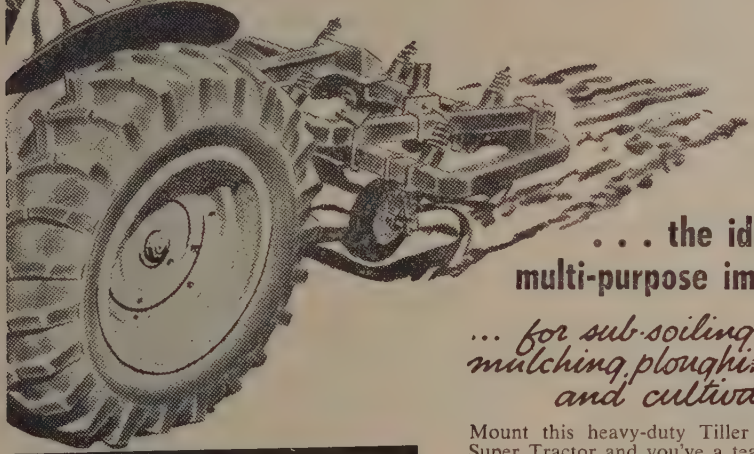

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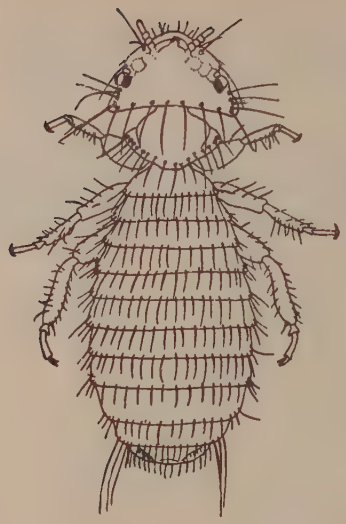

Fig. 7.—Female Body Louse (enlarged)
(After Herms)

sulphur, one part kerosene). Dipping the feet in kerosene will give good results, but getting any on the feathered portions of the leg may result in some burning, Repeated treatments may be necessary.

The treatment of the perches must also be carried out by painting them with old sump oil or kerosene.

THE DEPLUMING MITE

Cnemidocoptes gallinae (Railliet).

The depluming mite is closely allied to but slightly smaller than the scaly-leg mite. It has a comparable life history but attacks the fowl near the base of the feathers instead of on the legs and toes. Its attack start on the body and may progress to the neck, head and thighs. The mites themselves do not cause the bird to lose its plumage, but the intense itching they produce impels the bird to pluck its feathers in an attempt to reduce the irritation and a bald patch soon results. The affected quills will be found surrounded by scales and crusts and this condition frequently spreads rapidly.

Hosts.—The common host is the domestic fowl, but it also attacks other birds such as pigeons, pheasants, etc.

Control.—Local application of 20% benzyl benzoate emulsion or dipping the fowls in a fluid containing 0.1 per cent. lindane will give complete cure. To prevent spread through the flock it is necessary to treat all those that have had contact with an infection.

LICE AND FLEAS

Lice.—There are about 40 species of lice which are known to occur on poultry. Different types are to be found infesting various portions of the body, and so in the case of the fowl there are wing lice (*Lipeurus caponis*), body lice (*Menacanthus stramineus*), head lice (*Lipeurus heterographus*), fluff lice (*Goniocotes hologaster*), shaft lice (*Menopon gallinae*).

Bird lice are wingless parasitic insects with the mouth parts adapted for biting. The latter feature is not generally appreciated as so many lice found on furred animals are blood suckers that popular opinion regards all lice as such.

Unlike ticks and mites, lice remain permanently on the host bird. Opportunity exists for transfer to other birds, however, per medium of crowded roosts, during copulation, while a hen is covering chickens or where infested and clean birds use the same nest.

Generally, each species of bird has its own species of lice, but if the two lots of birds are housed or running together, e.g., fowls and turkeys, one frequently finds the same species of lice on them both.

Fig. 8.—Shaft Louse
(enlarged)
(After Giebel)

The damage done is due to irritation caused by their constant moving about on the bird and their feeding activities. As stated above they do not suck blood but eat the scales of the skin and the base of the feathers.

Fig. 9.—Wing Louse (enlarged)
(After Giebel)

The effect of this on the bird need hardly be stressed, as it must reflect itself in a reduction in egg production, and if the infestation is heavy, a loss of weight. It depends on the thriftiness of the birds as to what degree of infestation they can stand without showing the effects. Heavy infestations are generally associated with overcrowding and uncleanliness.

Life History.—In general, lice spend the whole of their lives on one host, except as mentioned above. The eggs are laid singly over a period of three weeks or so, and are attached to the base of the quills or on the feathers by a sticky secretion, and are popularly known as nits. The eggs are commonly seen in dense clusters, being greyish in colour. These eggs hatch in from five to eight days and the young insects closely resemble adults, but are of course smaller. After feeding they moult, i.e., shed their skins and increase in size. This process is repeated several times during a period of three to four weeks, at the end of which time they are fully grown.

The adult is a small elongated, flattened insect and in the case of the body louse about $\frac{1}{8}$ inch long. The general colour is greyish, sometimes with black marking. The six legs are provided with special claws to facilitate the insect running amongst and clinging to the feathers of the host. The mouth parts are on the under surface of the head.

Control.—Lice can be effectively controlled with DDT and BHC. In addition to the control of lice, bugs, and fleas, which is also a property of DDT, BHC has an effect on mite pests. The odour of BHC can be avoided by using lindane.

Fig. 10.—Fluff Louse (enlarged)
(After Denny)

Fig. 11.—Stickfast Flea (enlarged)
(After Mönnig)

Fig. 12.—Larva of Stickfast Flea (enlarged)
(After Campbell)

A single dusting with BHC will eradicate lice if properly carried out. One per. cent. BHC dust should be used. Attention must be paid to the head, neck, vent, and bare area below the wings. There is sufficient insecticide retained in the feathers to kill newly hatched nymphs.

Dipping on 0.2 per cent. DDT, or 0.1 per cent. BHC suspensions should only be carried out in extreme conditions. The dip should be made up with tepid water and done early in the day to allow the birds to dry before nightfall.

Dusting with sodium fluoride is also effective.

The well-tried black leaf 40 techniques also give good control. One half ounce per 100ft. of perch, ½ hour before the fowls go to roost. The fumes which arise from this will kill the lice.

With head lice, particularly in the case of chickens, application of a non-irritating oil such as castor oil or neatsfoot oil should be applied directly to the affected areas.

When treating birds for lice, particular attention should always be paid to male birds, as they can be the means of distribution.

Fig. 13.—Head of fowl heavily infested with "Stickfast"
(After Newman and Allman)

FOWL STICKFAST FLEA

Echidnophaga gallinacea Westw.

This serious pest of poultry was first recorded in Western Australia at Geraldton on native animals in 1913, but it was not until 1920 that it was first noticed in the metropolitan area as a pest of poultry.

Hosts.—The hosts of the stickfast flea are extremely numerous. The pest has been found attacking all poultry and many other birds, also dogs, cats, horses, rabbits and numerous native animals, and even man himself.

Description.—The stickfast flea is light brown to brownish black in colour, the male being smaller and darker than the female. Both are smaller than the common dog and cat fleas, and are characterised by the fact that they attach themselves to their host, bury their mouth parts into an exposed spot and remain there for the rest of their lives. A favourite place is on the head of the bird, which may become literally black with fleas, but at moulting time they may also be found on the breast, under the wings and around the vent.

The effect of the flea on the bird is to weaken it from loss of blood. In heavy infestations the anaemic condition of the bird is indicated by the pale comb. Adult fleas have been known to live three months without a host.

Life History.—The complete life cycle takes about four weeks, varying according to the temperature. The female fleas lay at night while attached to the bird, and the eggs fall to the ground. The eggs are minute white objects from which in about four days a small worm-like creature emerges. This feeds on organic material, principally the dried blood excreted by the adult fleas, and shelters in the surface dust and litter on the soil. After several moults it grows to a length of about $\frac{1}{8}$ inch, ceases to feed and burrows down into the soil to a depth of about six inches. Here it spins a silken cocoon within which it develops into an adult flea. This last stage occupies about two weeks, then the adult flea emerges, burrows its way to the surface and searches for a host.

Control.—All new birds should be examined in order to prevent the introduction of the flea. Fleas may be controlled by smearing the infected parts with a non burning oil, castor or neatsfoot oil, or by the application of a sulphur ointment, care being taken not to contaminate the eyes.

Complete dipping in 0.5 per cent. DDT suspension or a 0.25 per cent. BHC suspension will kill fleas on the birds.

The floors of the henhouse should be made of concrete to facilitate cleaning, as it is in the dust and litter that the immature forms develop. The floors, roosts and nesting quarters should be sprayed with creosote oil. One half gallon will cover 1,000 square feet. A 5 per cent. DDT solution in kerosene, or a 5 per cent. emulsion in water can be used in place of creosote.

SAFETY PRECAUTIONS

The careless use of many modern insecticides can cause mortality amongst poultry flocks and have an adverse effect upon the health of operators.

Care should be taken to ensure that spray concentrates do not come into contact with the skin and sprayers should not inhale the spray mist. Any spray contamination should be washed off the skin with warm soap and water.

Drinking vessels, food containers and food scraps should not be contaminated with insecticides during the treatment of poultry yards.

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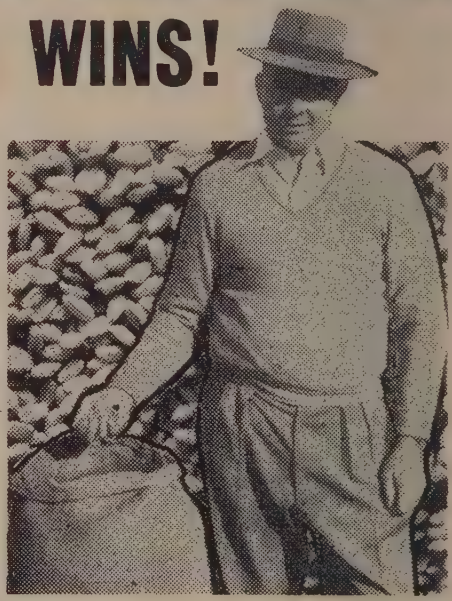

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The Queensland-type water tower at the Denmark Research Station

COOLING MILK ON THE FARM

A summary of results of an experiment conducted at the Denmark Research Station

By H. M. LISTER, Officer in Charge, Dairy Factory and Produce Supervision

IN Bulletin No. 968, issued by the Department of Agriculture in 1949, and in the book "Dairying in Australia (W.A. Edition)" there is described a water-cooler tower for use in cooling milk on the dairy farm. This type of tower has gained much prominence in Queensland and is now in general use on dairy farms in that State.

The Dairy Division of the Department of Agriculture in Western Australia has for many years advocated the cooling of milk and cream on farms in this State as a means of raising the quality of milk or cream, but the response by farmers has not been satisfactory. In the wholemilk areas in the State it has been said that, because of twice a day pick-up of milk, there is not much need for cooling on the farm other than by running the milk over an ordinary pipe cooler through which tank water is circulated. It is doubtful whether the temperature reduction brought about by this method would assist much in retarding bacterial increases.

Its efficiency would, of course, depend on the temperature of the water used. Generally on the farm the water used on the cooler circulation is piped from an overhead storage tank and the water in the late spring and summer months may have a temperature of up to 80° or 90° F. which would be useless for the reduction of milk temperature.

On those farms where the mill which supplies the water is close to the dairy, water can be delivered direct to the cooler from the mill but here again a problem is encountered—the breeze to drive the mill at milking time may not be available, and therefore the windmill may be inactive at the time when it is most wanted.

Ground water temperature can vary considerably and ranges between 55° and 78° F. or even higher under certain conditions. The temperature largely depends upon the depth from which the water is drawn. In summer the average temperature of a shallow well could be between 70° and 78°—much too high for effective cooling of the milk.

In areas of the State where milk is supplied to cheese factories the position is worse because practically no cooling of milk is carried out on the farm, hence the amount of second-grade milk delivered to cheese factories is relatively high.

While it is not the wish of the writer to weary the reader with a lot of figures, it is desired that the farmer realise how bacteria can increase under favourable temperature conditions.

The table below shows the increase of bacteria in milk held for 24 hours at various temperatures:—

Temperature. °F.	Bacterial Count. Per cc.
32	2,400
39	2,500
43	3,100
50	11,600
55	18,800
60	180,000
68	450,000
86	1,400,000,000
95	25,000,000,000

It will be noted that in the range 32° to 55° F. comparatively little growth was noted. Between 55° and 68° F. the growth was fairly rapid and above 68° F. the increased growth was fantastic. These figures, which are authentic, show very clearly that if we are to raise the quality of the product produced, two things are absolutely necessary:—

(1) High standard of hygiene.

(2) Cooling of milk or cream as produced.

Cooling, to be really successful, must reduce the milk temperature as close as possible to 50° F. How then can farm tank water be reduced to a lower temperature than normal to bring this about?

It was with regard to the latter that the Department of Agriculture, Dairy Division, decided to experiment with the Queensland type water tower in order to demonstrate to the dairy farmer in this State that, with the expenditure of a small amount of cash and a little labour, milk cooling on the farm could be carried out quite easily and give good results. To this end with a minimum of cost, a Queensland type water cooling tower was erected at Denmark Research Station.

CONSTRUCTION AND DESCRIPTION

The construction was as described in the Department of Agriculture Bulletin 968 (a few copies of which are still available), and in "Dairying in Australia (W.A. edition)." The system of cooling is by water recirculation from a shallow concrete pit at the foot of the atmospheric cooling tower. The water is drawn from this pit (which is only 12 in. deep) by a ¾ in. centrifugal pump driven from the dairy engine room shafting. The water is pumped through an ordinary milk cooler mounted in brackets at a suitable height beneath the milk vat stand. The water, after cooling the milk, is delivered back to the top of the cooling tower. The tower is placed so that it is in the path of the prevailing winds, especially those which blow in the summer months for it is at this period that the largest amount of cooling is required.

The tower need not be far distant from the dairy so long as there is plenty of air circulation on all sides of the tower.

Large amounts of water are not really necessary. The pit shown in the plans only holds approximately 180 gallons. A deep pit is not recommended as there is a tendency for a large bulk of water to heat up considerably in the summer and the heat has to be dissipated on the tower before efficient cooling can be achieved.

Hence a small bulk cools quicker and is available for the necessary work in a shorter time. The shallow pit has other advantages:—

(1) Low cost.

(2) Ease of cleaning when necessary.

(3) Easier lift for the pump, therefore greater circulation of the water.

SITUATION OF TOWER

In the experiment at Denmark Research Station, the cooler tower was built approximately 55 ft. from the dairy. Conditions were such that it was not possible to build it closer and have good air circulation all round the tower. This was a distinct disadvantage because it meant greater length of pipes and therefore more friction inside the pipe and a slight reduction in water circulation capacity.

SITUATION OF PUMP

The water pump was installed in the separator room and driven off the separator counter shaft at 1,250 r.p.m. Approximately 60 ft. of 1 in. piping was laid down from the pit to the pump with a foot valve on the suction end.

CAPACITY OF PUMP

Water delivery at the pump was approximately 500 gallons per hour, which was considered sufficient to cool 166 gallons of milk per hour at the rate of 3 gallons of water to 1 gallon milk.

The cooler used was an ordinary tinned copper pear-shaped tube milk cooler 2-can size—9 pipes high approximate size 30 in. wide x 18 in., deep with ¾ in. water connections. Delivery of water through cooler was approximately 400 gallons per hour with the pump speed of 1,250 r.p.m.

COOLER WATER RETURN

Water passing through the cooler was piped back to the top of the tower at 13 ft. height through ¾ in. galvanised piping at a flow of approximately 277 gallons per hour at top of tower.

The cooler water then falls down over the slats in the tower in droplets and reaches the pit from where it is recirculated again through the cooling plant.

The cost of materials used in the construction of the tower and pit, plus the piping used to reticulate the water and the ¾ in. centrifugal pump was approximately £37 10s.; the work of erection of stand and the cementing of the circulation pit and laying of pipe lines being done by the Research Station staff.

COOLING TOWER EXPERIMENT—DENMARK RESEARCH STATION

Monthly Temperature Avgs. Degrees Fah.

	MORNING							EVENING						
	Temp. Milk in Vat.°	Temp. Cooled Milk°	Temp. Drop Fah.°	Temp. Pit Water Fah.°	Diff. Cooled Milk-Water	Atmos. Temp.	Diff. Atmos. and Pit Water	Temp. Milk in Vat.°	Temp. Cooled Milk°	Temp. Drop	Temp. Pit Water Fah.°	Diff. Cooled Milk-Water	Atmos. Temp.	Diff. Atmos. and Pit Water
1956—														
July	79·00	59·71	19·29	47·03	12·68	49·00	—1·97	79·94	62·74	17·20	50·61	12·13	53·39	—2·78
August	81·20	50·53	25·67	45·13	10·40	47·93	—2·80	80·13	57·20	23·93	49·80	7·40	54·53	—4·73
September	79·76	55·52	23·24	47·38	8·14	50·07	—3·29	79·41	59·34	20·07	53·14	6·20	58·45	—5·31
October	81·77	59·37	22·40	49·77	9·60	52·23	—2·46	82·43	62·33	20·10	55·57	6·76	57·87	—2·30
November	85·17	62·27	22·90	54·00	8·27	56·07	—2·07	86·48	66·59	19·89	60·62	5·87	64·21	—3·59
December	87·84	66·10	21·74	58·03	8·07	60·45	—2·42	89·32	69·23	20·09	62·16	7·07	67·52	—5·36
1957—														
January	88·94	67·16	21·78	59·23	7·93	62·97	—3·74	90·23	71·39	18·84	63·90	7·49	72·84	—8·94
February	86·10	65·50	20·60	58·50	7·00	61·30	—2·80	88·90	71·20	17·70	68·00	3·20	73·40	—5·40
March	84·00	61·10	22·90	56·51	4·59	59·42	—2·91	87·67	66·45	21·22	61·77	4·68	69·10	—7·33
April	80·40	57·40	23·00	52·68	4·72	55·10	—2·42	84·80	63·70	21·10	60·10	3·60	64·70	—4·60
May	80·30	56·77	23·53	51·70	5·07	54·00	—2·30	84·74	62·60	22·14	57·40	5·20	61·40	—4·00
June	82·90	58·60	24·30	51·40	7·20	53·60	—2·20	85·60	61·70	23·90	55·80	5·90	57·40	—5·90

The experiment was carried out over a period of 12 months.

Temperature recordings were made at both milkings as follows:—

(1) Temperature of milk at vat.

(2) Temperature of cooled milk.

(3) Temperature of pit water.

(4) Atmospheric temperature.

From these figures the general temperature reductions were worked out and averages drawn for the month and the difference between the cooling medium and the cooled milk were worked out.

WATER CIRCULATION

Circulation of the cooling water from the pit through the cooler commenced with the starting up of the engine used for milking and this circulation was responsible for the reduction of the water to an average of 2.6 degrees F. below the ruling atmospheric temperature for the period in the mornings and 5° F. in the evenings prior to the commencement of the actual cooling process.

MILK TEMPERATURES

It will be seen from the table printed herewith that the milk temperatures at the milk vat are relatively low, but it must be explained that bucket milking rather than pipeline milking was practised for the larger portion of the period of the experiment.

Had normal milk temperatures been the rule, reduction of temperature between vat milk and cooled milk would have been greater than those listed.

It will be noted that the drop in temperature of the milk over the cooler ranged from 19.29° F. in July, 1956, to 24.3° F. in June, 1957, with an average for the 12 months of 22.61° F. and the evening period reduction 17.2° F. to 23.9° F. with an average reduction for the 12 months of 20.43 ° F. These figures indicate quite clearly that, for a normal outlay, reasonably good cooling of milk can be carried out on the farm with the aid of the cooling tower and with only a relatively small quantity of water, and should be quite within the reach of the average farmer.

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MARKETING OF VEALER CARCASSES

Some Points on Avoiding Condemnations

EVERY year, dairy-farmers and others dispose of large numbers of surplus calves as vealers, forwarding the carcasses for sale at the Metropolitan Markets. Carelessness, or lack of knowledge of how the carcasses should be prepared for sale, often leads to wastage, and a proportion of the calves are condemned by Health Department inspectors as unfit for human consumption.

The following notes have been prepared by officers of the Health Department in an endeavour to assist producers to present carcasses in a marketable condition.

IMMATURITY

The accepted standard of maturity for vealer carcasses is that the calf should weigh at least 40 lb. dressed and should be not less than 14 days old when killed.

Apart from the weight, the condition of the umbilical cord and the kidney fat are the chief factors which indicate maturity.

The greatest proportion of condemnations of veal at the markets is for immaturity and it is felt that much wastage could be avoided if the calves were kept for a further two or three weeks before slaughtering.

PUTREFACTION

Carcasses sometime arrive at the markets at a fairly advanced stage of putrefaction. In most instances this could have been avoided by observance of the following points:—

1. The **complete** removal of the intestines, etc.

2. The thorough cleaning of the internal surfaces of the carcass, especially in the region of the kidneys and the neck. The best method of cleaning is with a clean cloth, wrung out to dampness—being particularly careful to avoid any excess moisture.

3. To allow the dissipation of body heat, the carcass should be hung for a period of 6 to 12 hours after killing and stretchers inserted to allow a complete circulation of air. (It is most important to this stage to protect the carcass from flies to prevent it becoming flyblown.)

The crutch and the neck should be thoroughly opened up.

BRUISING

Careless or rough handling of calves prior to slaughter can lead to extensive bruising. Dogs should not be used when driving calves as a biting dog can cause bruises which lead to condemnation of the carcass.

LACK OF CLEANLINESS

In order that the carcasses arrive at the markets in a clean condition, each one must be provided with a covering as a protection against flies and contamination. A fairly open-textured hessian such as a clean chaff-bag would be suitable, but closely-woven material such as is used for cornsacks does not permit adequate air circulation and should be avoided. The wrapping material must be clean—avoid using bags which have contained fertiliser, or dusty, strong-smelling substances.

HEAVYWEIGHT CARCASSES

Carcasses weighing over 150 lb. dressed are classed as "baby beef." This necessitates branding on the buttock, on the outside of the ribs and on the shoulder, as well as on the inside of the pelvic cavity.

To facilitate branding, the hide should be flayed back at the points mentioned and then replaced to protect the meat during transportation.

Normal-weight vealers are not flayed.

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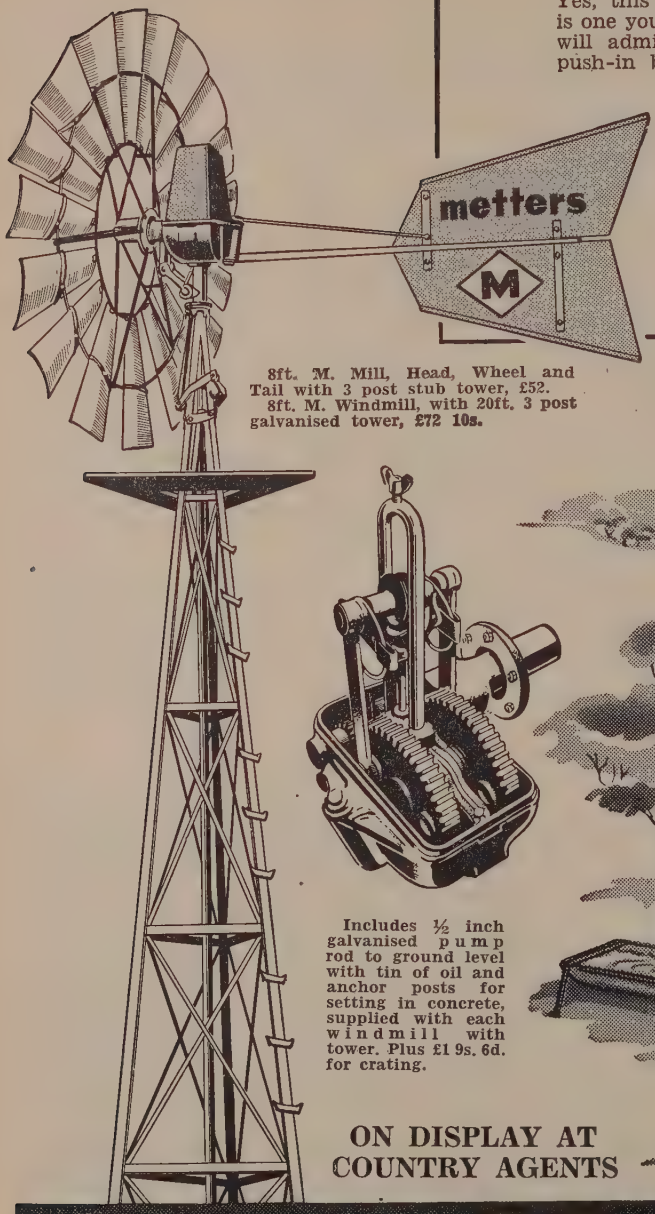

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VIBRIOSIS IN DAIRY CATTLE

By C. R. TOOP, B.V.Sc., Chief Veterinary Surgeon

IT is about five years now since vibriosis was first diagnosed in Western Australia, but there can be little doubt that the disease had already become firmly established in the dairying districts long before its recognition. At that time diagnosis presented a problem, for none of the diagnostic tests in common use in other countries were yet available, and tedious bacteriological examinations, either of aborted calves or the secretions of affected animals were necessary in order to establish the presence of infection.

The matter has now been simplified by the application of the mucus agglutination test which was recently developed at the Animal Health Laboratory, and it has enabled a diagnosis to be provided within the space of a few days. The mucus agglutination test is not highly reliable—it is a herd test rather than a test for the individual animal—but provided a sufficient number of suitable samples is submitted, it is possible to determine with a reasonable degree of accuracy whether a herd is affected.

During recent months, 66 herds which had been found to be affected by an infertility problem, mainly as the result of poor conceptions to artificial insemination have been tested, and about 75 per cent. of them have given positive reactions. It had been suspected from herd histories that the infection was widespread, and these findings have confirmed that vibriosis is prevalent throughout the dairying areas, and they indicate that it is the principal cause of temporary infertility.

Bovine infertility, it is true, is a complex in which other factors including dietary and physiological causes as well as other infections may be involved, but in the problem as it exists in Western Australia at the present time, these factors would seem to be of secondary importance.

Vibriosis or vibrionic abortion as it is sometimes called, is a venereal infection, and while it may be spread by channels other than service, this occurrence is so rare that it need not, for practical purposes, be considered. When the disease makes its appearance in a herd, it is invariably associated with the introduction of an infected bull or of infected cows, both of which can spread the infection.

SYMPTOMS

The principal manifestation is delayed conception, often associated with irregular oestrus or heat. In the early or acute stages of the disease, conception rates are low, and as few as 15 per cent. of the cows or at best about 40 per cent. become pregnant to the first mating. The remainder return to service repeatedly, often at irregular and abnormally long intervals. The evidence suggests that in many cases conception actually occurs, and that it is followed by foetal death and the subsequent re-absorption or explusion of the foetus.

DEVELOPED IMMUNITY

As the result of exposure, cows gradually develop a tolerance or immunity to the infection, and with the exception of a small proportion that may still remain infertile will commence to breed normally after an interval of three to six months. Thus in the later or chronic stages of the disease, fertility becomes fairly satisfactory.

Heifers and young cows however, will continue to present a problem, and difficulties will usually be experienced with each succeeding group each year. These animals will become infected after their introduction into the herd, and since they

will not have developed an immunity from previous exposure, their breeding efficiency will be temporarily impaired. Some abortions may occur—usually between the fifth and six months and most often in cows which conceived to the first mating—but this is not a prominent feature of the disease, and the abortion rate is usually low.

The majority of cows which calve at full term become free of infection, but others may remain as carriers and can become an important factor in maintaining the disease within a herd and spreading it to others.

Infection in the bull is permanent and once established, it persists for life. It will thus be seen that the control of vibriosis in herds where natural service is practiced, presents a most difficult problem.

CONTROL

As a first step towards control, maiden heifers should be mated with young unused bulls. This will ensure freedom from infection and satisfactory conceptions may be expected. After entering the herd as young cows, and for the rest of their lives, these animals must continue to be bred to a clean bull, and it is here that difficulties are likely to arise. The infected cows may continue to be mated to the infected herd bull, and since they have become tolerant to the infection, they may be expected with a few exceptions, to breed normally, and with the passage of time they will gradually be eliminated. By this means a non-infected herd could eventually be established.

This procedure however, is unlikely to be found practicable on the average dairy farm—the regulation of services to clean and infected bulls would obviously present its problems—and should an accidental and undetected mating occur in either group, the whole system would break down and the disease would spread through the clean section of the herd.

A herd that is free of vibriosis will of course, remain free provided introductions are confined to young, unused bulls, and replacements are bred on the property, and owners of herds in which an infertility problem has not been experienced would be wise to observe this precaution.

In the treatment of vibriosis, irrigation of the genitalea with the antibiotics streptomycin and penicillin, is recommended, and while this may shorten the course of the disease and result in earlier conceptions, it does not eliminate the infection, and makes no contribution towards ultimate eradication. Furthermore, vibriosis is to a large extent, a self-limiting disease, and there is often a tendency to place too much emphasis on the value of treatment.

Bulls may also be cured by treatment, but while female carriers remain in the herd this can serve little purpose. This brings us to a consideration of artificial insemination and since it eliminates sexual contact which is virtually the only method of infection, it quite obviously provides the only effective method of control.

ARTIFICIAL INSEMINATION

All of the bulls in use at the Artificial Breeding Centre at Wokalup are certified free of vibriosis by the application of the most exacting tests which ensures that no infection is carried in the semen distributed. It is only to be expected in the first year of artificial insemination that infertility problems will be encountered in herds where vibriosis is active, but as the mature cows will become tolerant and heifers and young cows will not be exposed to infection, it is reasonable to anticipate that this problem will recede and eventually disappear in the subsequent years.

No headway, however, will be made while herd bulls are retained and used in conjunction with artificial insemination. Some farmers fearing that artificial insemination might not prove successful have kept their bulls, and at the first suggestion of unsatisfactory conception rates, have resorted to natural service.

This practice can only result in the spread of infection to previously unexposed females and the creation of additional infertility problems, and it should be remembered that natural service can achieve nothing that cannot be accomplished by artificial insemination.

(From a recent A.B.C. Country Hour broadcast.)

Fig. 1.—Dense third year pasture of sub clover and Wimmera ryegrass at wilting stage (October, 1957) on property of Mr. J. W. White, Badgingarra

LIGHT LAND DEVELOPMENT IN THE WEST MIDLANDS

By B. F. CARLIN, B.Sc. (Agric.),
Agricultural Adviser

ALTHOUGH it has not received the widespread publicity which has attended land settlement schemes on the south coastal plain some very successful light land development has taken place in the West Midlands during the past 10 years. Large areas of what was once unattractive scrub country are now carrying highly productive pastures and the progress made by Mr. J. W. White at Badgingarra is an example of what may be achieved in this district by using proven techniques.

The West Midlands area lies west of the Midland Railway between Mingenew in the north and Gingin in the south. It has an assured winter rainfall ranging from about 16 in. per annum in the north-east portion to over 30 in. in the south-west.

Complete settlement of the area has been delayed by the variability of the soil types and the occurrence of large areas of infertile deep sand, the difficulty of obtaining underground water at a reasonable depth, and the problems of transportation—but notwithstanding these handicaps a large area has been brought into production.

For successful development the settler must have a reasonable block, sufficient capital for its development and the necessary knowledge of light land development. As can be seen from the accompanying photographs Mr. J. W. White of Badgingarra has been successful in establishing good pastures of sub clover and Wimmera rye grass. He initially took up a block of 2,500 acres in 1952 and 2,200 had been cleared by 1957.

The land shown in the illustrations was fallowed to a depth of 4 to 5 in. with a heavy disc plough in July, 1953. (Most of the area was not previously burnt but better results were obtained on the burnt areas.) It was then ploughed back in September. In April, 1954, it was seeded with a disc drill sowing 40 lb. of Ballidu oats and 150 lb. copper and zinc super per acre. The oats yielded 24 bushels per acre. The stubble was then burnt and the area ploughed to a depth of 5 in. with a Chamberlain disc plough, and 40 lb. Ballidu oats, 6 lb. Dwalganup sub clover, ½ lb. Wimmera ryegrass and 150 lb. super per acre were sown in April, 1955. The oats from this crop yielded 18 bushels per acre. In 1956 and 1957 the area was topdressed

Fig. 2.—General view of third year pasture of sub clover (Dwalganup) and Wimmera ryegrass on property of Mr. J. W. White, Badgingarra

with 120 lb. super per acre applied with a disc drill.

By efficient removal of the harsh native vegetation and the use of adequate dressings of superphosphate, Mr. White has successfully established highly productive pastures. The soil types on this block represent some of the better types of heath plain soils. Most of the block is sand over clay at 3 to 24 in. below the surface, or sand over gravel at similar depths. There are also restricted areas of heavier land carrying york-gum and white-gum. Champion Bay poison occurs on the sand over clay association.

RECOMMENDATIONS

There are a number of fundamental principles which must be observed in the successful development of light land. These are—

(1) The settler must make sure that the block is worth developing before any work is done. Blocks with large areas of deep white or grey sand should be avoided.

(2) He must make sure that he has sufficient capital to finance efficient development and provide a living if he has no other income until the block becomes productive.

(3) He must have a good plant based on a heavy disc plough, a big tractor and a disc drill.

(4) All working should be done very efficiently. The native scrub should be completely removed by burning and at least two ploughings given before the first crop is sown. Cropping should be carried out on good clean fallow in order to get a crop which will provide a clean stubble burn which in turn will help to control regrowth and poison.

(5) Fertiliser application should be heavy in the initial years so that the pasture will get away to a good start and produce a bulk of feed. About one bag of copper-zinc-super per acre should be used in the first year.

(6) Development should be planned progressively for several years ahead so that it can be carried out in such a manner that it never places too great a strain upon the settler's physical and financial resources.

This litter is healthy and flourishing, but deaths among young piglets are far too common

DISEASES OF THE FARROWING SOW

By A. W. WILLIAMS, B.V.Sc., Government Veterinary Surgeon

SOME of the heaviest losses incurred by the pig industry are caused by diseases affecting sows just prior to, or immediately after, the birth of their litters. Most of the wastage is caused by the birth of dead or weakly piglets or the loss of litters due to the subsequent failure of the sows to provide an adequate milk supply.

Agalactia, or failure to produce milk, may be due to under-development of the mammary glands—a fault which may be hereditary—but in the majority of cases it is due to diseases such as milk fever (a deficiency disease) or mastitis and metritis which are caused by bacterial infections.

PREVENTION

Careful selection of breeding stock from sound, healthy strains; good housing and management, and adequate, well-balanced feeding can help to reduce farrowing losses.

During her period of pregnancy, the sow should receive ample supplies of protein-rich foods but should not be allowed to become grossly fat.

Supplementing the grain ration by grazing on good pasture is ideal as the animal can move around and maintain its muscular tone, while ensuring an adequate intake of nutritious food.

Ample supplies of clean water should be available at all times and the sties and farrowing pens should be cleaned and disinfected, prior to the birth of the litters.

Always remember that an animal which is well-fed and well-managed has a much better chance of resisting infection than one which is neglected.

MILK FEVER

Most dairymen are familiar with the disease which is commonly termed "milk fever." It affects dairy cows fairly frequently and is also encountered in sows at, or immediately following, the birth of a litter.

The title is somewhat misleading as the disease does not produce a feverish condition—in fact the body temperature often drops below normal.

The correct term is parturient hypocalcaemia. "Parturient" refers to the act of giving birth and "hypocalcaemia" indicates a deficiency of calcium or lime.

This does not necessarily mean that there is an actual calcium deficiency in the animal's diet. Milk fever is caused by a sudden drop in the level of calcium in the blood and an animal could be feeding on a calcium-rich diet and still suffer from hypocalcaemia if the complex processes govering the calcium supply to the bloodstream failed to operate effectively.

Milk secretion makes heavy demands upon the calcium salts in the bloodstream and when the blood calcium level is lowered the animal loses its appetite, and shows a loss of muscular control. It goes down and is unable to rise, lapses into a coma, and dies if treatment is not applied.

Treatment.

The standard remedy for milk fever in cows is to give an injection of calcium borogluconate either into a vein or under the skin.

A similar treatment is effective for sows using a subcutaneous injection of 1 oz. calcium borogluconate dissolved in 5 oz. (a quarter of a pint) of boiling water and allowed to cool to blood heat before injection. The insides of the thighs where the skin is fairly thin would be suitable injection sites.

Ready-prepared solutions which usually contain 2½ oz. of calcium borogluconate are available and these are more convenient to use. A little more than a third of the solution is required to supply the equivalent of 1 oz.

In most cases, one injection is sufficient and recovery should occur in about three-quarters of an hour. If necessary another injection may be given six to eight hours later.

Where the calcium borogluconate injections fail to take effect, give a further injection of 1 oz. magnesium sulphate (Epsom salts) with 6 oz. of 50 per cent. glucose dissolved in half a pint of water.

Occasionally, a sow may show marked excitability instead of the usual comatose tendency. In such cases, an injection of ⅛ oz. magnesium sulphate and ½ oz. calcium borogluconate has been found satisfactory.

To avoid deaths from over-laying, the piglets should be taken away from the sow while she is suffering from milk fever. As milk fever often leads to constipation, a laxative such as a cup of molasses or some bran should be given to the sow on recovery.

METRITIS
(Inflammation of the Uterus)

While this condition can occur in sows of all ages, it is more common in maiden sows. It may follow a history or difficult farrowing or the birth of dead and putrid piglets.

It is caused by a bacterial infection of the womb, but not necessarily by one particular type of organism.

The symptoms observed in the sow are essentially similar to those found in milk fever with the exception that a higher temperature will usually be found in this condition.

A slight discharge of fluid containing pus may issue from the vagina.

Treatment with sodium sulphamezathine (33-1/3rd per cent. solution) at the rate of 3 ccs. per 15 lb. liveweight for the first day followed by 3 ccs. per 20 lb. liveweight for the next four days is perhaps the most satisfactory method for general use. Sulphamezathine is given by subcutaneous injection in the looser parts of the skin.

Sodium sulphamezathine for veterinary use is generally readily available from chemists and stock agents.

A less common type of metritis, which appears to be transmitted in breeding, may also occur. Little is known in regard to the cause and nature of this condition but it usually occurs in maiden sows or sows with large litters.

The first signs are usually seen about 12 hours after farrowing. Lactation ceases, the sow appears listless, has a staggering gait or she may be found down and unable to rise. As with the other type of metritis and also milk fever the animal

may pass into a coma and subsequently die after a variable period. In this type of metritis a purulent discharge from the vagina is almost invariably present.

The piglets are usually normal when born, but owing to a lack of milk may not survive for any length of time.

Sulphamezathine injections have been found most unsatisfactory in the treatment of this type of metritis, but streptomycin and terramycin have been used successfully. However, the use of these drugs is restricted to veterinary surgeons so that veterinary attention is desirable in these cases.

Some immunity appears to develop in sows which have been affected with this condition, as it is unusual for recovered animals to develop the disease a second time.

MASTITIS
(Inflammation of the Udder)

This disease is due to an infection of the udder tissue and there are a number of organisms which may be responsible.

Most infections appear to come from external injuries, although cold, damp conditions or draughts may also predispose to the disease. The incidence appears to be highest in excessively fat animals.

The disease usually affects sows immediately after farrowing but may be delayed for 48 hours. The temperature is generally high (up to 106°) and the affected udder becomes grossly swollen, hot and painful. Reddening of the skin may be seen in white pigs.

The milk secretion is often dirty in colour with a "ropey" appearance or it may be very scanty or even absent.

Treatment with sulphamezathine, as recommended for metritis, is likely to be of value. Hot fomentations of the affected udder, when practical, should help to reduce the inflammation.

Unless treatment is successful, milk secretion may be lost from the affected glands. Where this does occur the sows are not likely to be of much value for breeding purposes and should be sold for slaughter.

Other types of mastitis occur where abscess formation with possible discharge on to the surface, will be observed. These types are due to other bacterial infections, e.g., tuberculosis, actinomycosis, etc., and will require veterinary assistance for diagnosis and treatment.

HAND-REARING PIGLETS

Sickness in newly-farrowed sows often leads to the death of the litter unless hand-feeding is practised.

If the piglets have been suckled by the sow for one day and received some colostrum or "first milk" they usually thrive on fresh undiluted cow's milk as this is not greatly dissimilar in composition to their natural food. It should be fed at blood heat.

Where no colostrum has been available, substitutes such as a whisked-up egg or a tablespoonful of olive oil or, castor oil added to a quart of cows milk, have been recommended for the first day's feeds, but their value is doubtful.

Milk is best given in a shallow dish. With a little perseverance in the early stages, the piglets will soon learn to drink. "Up-ending" them and dipping their noses in the milk will be found surprisingly effective. All vessels containing milk must be kept scrupulously clean by scalding them after each feed.

For the first week the piglets should be fed six times in each 24 hours but the number of feeds can then be decreased gradually until they receive three feeds daily at three weeks of age. At this time a supply of dry ground grain—four parts of grain to one part of meatmeal—should be available at all times, together with a supply of clean drinking water. If the piglets can be given access to a well-grassed run they will probably benefit by grazing also.

Warmth is Important.

More hand-reared piglets die from chills than are lost through incorrect feeding. Young pigs are very susceptible to cold and should be kept in warm, dry, draught-free quarters with plenty of litter and coverlets where necessary. Extra heat may be provided at night by brooder-lamps or hot-water bottles.

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INTEREST IN NEW PLASTIC PIPING

America's best recognised and generally accepted type of plastic piping has now been introduced to the Australian market.

Manufactured by Die Casters Limited in Melbourne, from a proven plastic alloy of Styrene Butadiene Acrylonitrile, a hard tough Chemical resistant copolymer with high temperature resistance, Dicon "K" type pipe and pipe fittings have been engineered after eight years experience in the United States of America and four years of experimentation and testing in Australia.

The raw material is known as "Kralastic" and the fact that this piping has withstood actual tests upon installation where termites have attacked all other types of plastic will be of great interest in W.A.

This new plastic pipe is the only type which the C.S.I.R.O. Entomological Division consider immune to attack from all the most aggressive types of known termites south of the Australian tropic line.

In our tropical regions there is the additional hazard of Mastotermes which can exist only in certain areas. The P.M.G. Department have been carrying out tests in these areas for the past 12 months and are continuing and expanding these. To date they have been unable to find any instance of attack on this new type of plastic piping whereas they report cases of attack on all other types and even on lead conduits and concrete compositions.

In addition to its other features Dicon "K" type piping is stronger and tougher than anything previously available; so this, combined with the other generally accepted advantages of plastic piping, the big price advantage and the fittings will interest all West Australians who are considering reticulation and irrigation.

MANGANESE DEFICIENCY IN THE CEREAL-GROWING AREAS

By S. T. SMITH, B.Sc. (Agric.), Senior Soil Research Officer, and W. J. TOMS, B.Sc. (Agric.), Research Officer

MANGANESE deficiency in cereal growing areas of Western Australia appears to be restricted to some of the ironstone gravelly soils of certain districts. Wheat, oats and barley make poor growth on such soils unless the deficiency is remedied by applying manganese sulphate as a soil dressing or as a foliage spray.

Manganese is one of the trace elements which are essential to the healthy growth of plants. Most soils have adequate reserves of available manganese to satisfy the needs of plants. On deficient soils, however, small amounts of added manganese can give a normal crop where otherwise a complete failure would have resulted. It is, therefore, important to recognise manganese deficiency and to know the methods of controlling it.

TYPE OF SOIL AFFECTED

Within the area where cereals are normally grown for grain in Western Australia, manganese deficiency occurs only in relatively high level soils associated with lateritic outcrops. It does not follow however that all gravelly soils are deficient in manganese. Typically affected soils are very gravelly, particularly in the subsoil, and are usually very loose and powdery. The gravel is normally quite

Fig. 1.—General view of manganese deficiency on oats on a gravelly rise at Moulyinning. Note the areas of reasonably healthy plants occurring in the midst of those acutely affected

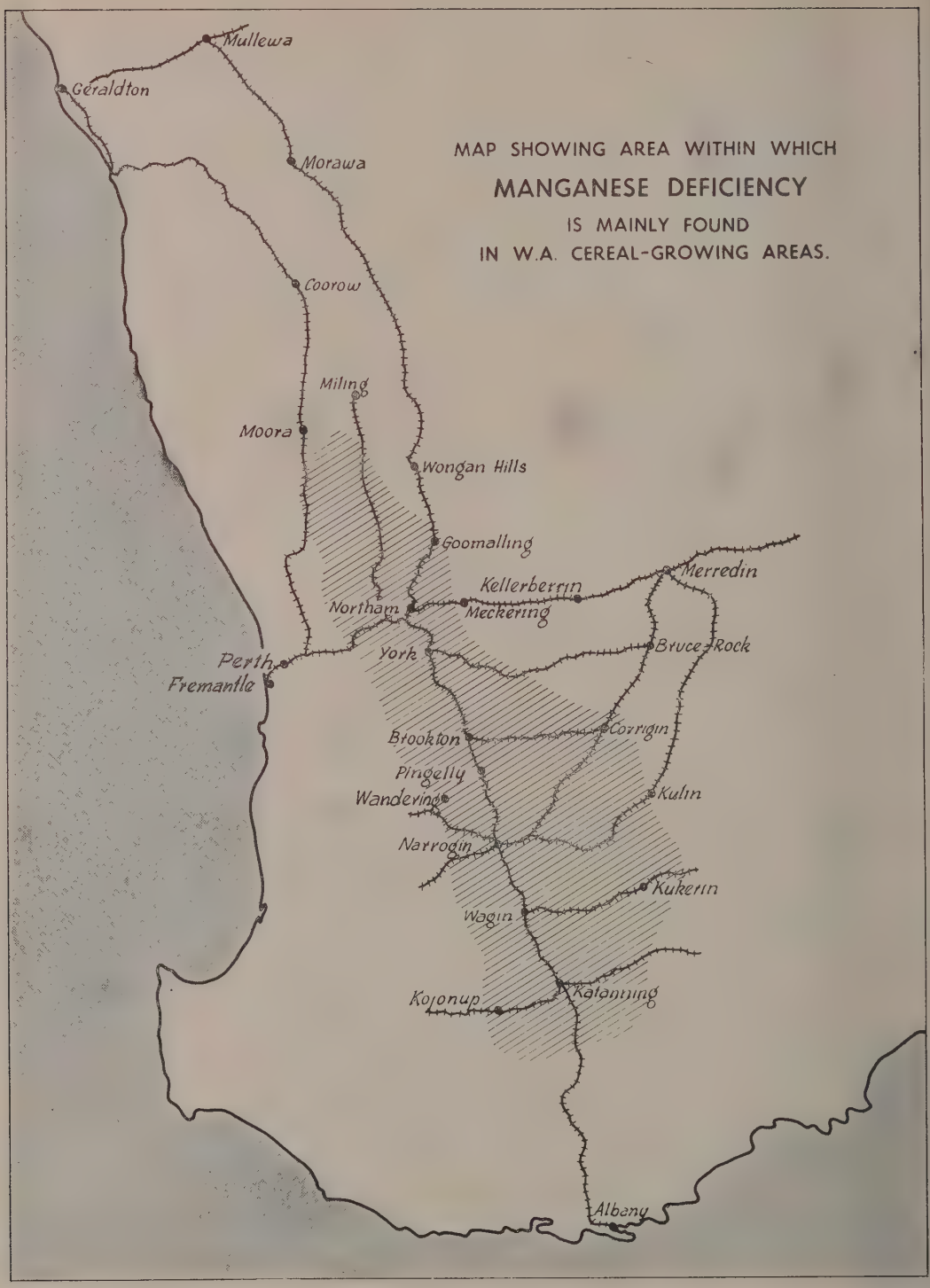
MAP SHOWING AREA WITHIN WHICH
MANGANESE DEFICIENCY
IS MAINLY FOUND
IN W.A. CEREAL-GROWING AREAS.
Mullewa
Geraldton
Morawa
Coorow
Miling
Moora
Wongan Hills
Goomalling
Merredin
Kellerberrin
Northam
Meckering
Bruce Rock
York
Perth
Fremantle
Brookton
Corrigin
Pingelly
Wandering
Kulin
Narrogin
Kukerin
Wagin
Kojonup
Katanning
Albany

Fig. 2.—A close view of manganese-deficient oats. Note general yellowing, collapsed appearance and death of lower leaves. Many leaves are showing the dead area at the centre of the leaf which is characteristic of manganese deficiency on oats

dense and irregular in shape. Manganese deficiency does not occur on fine-textured (clay) soils nor on sandy-surfaced, non-gravelly soil types.

The main area within which manganese deficiency on cereals is of importance is shown in the accompanying map. It is seldom found, further north than Moora or further east than Kulin. Affected soils extend to the extreme western boundary of the cereal-growing zone, and in this western region the deficiency is common on the gravelly soils associated with the eastern boundary of the Darling Range.

Within the area defined, the type of soil affected is of the same general nature although there are differences in the vegetation and topographical features of the land. In the western section extending from Moora in the north to Kojonup in the south, the soils are very gravelly and are associated with trees such as wandoo (whitegum) and mallet. This is the gravel hill country which forms the eastern section of the Darling Range. A little further eastward around Narrogin, Pingelly and Wickepin, the deficiency is most common on the sharp lateritic hills and ridges which, in the virgin state, also carry mallet and whitegum. These hills often rise as sharp lateritic pinnacles or breakaways. Farther eastwards, for example in the vicinity of Corrigin, Dudinin and Kukerin, the deficiency is found on the hilltops of the more gently undulating country, and is particularly associated there with the powdery gravelly morrel soils. However, it does not occur on the calcareous morrel soils which are frequently found in the eastern wheatbelt.

CROPS AFFECTED BY MANGANESE DEFICIENCY

The cereals, wheat, oats and barley are all fairly susceptible to manganese deficiency. Of the three, however, oats are the most sensitive. Some varieties of oats are less susceptible than others, but these varietal differences may not be large enough to be of practical importance on most of our manganese deficient soils.

Cereal rye is very resistant to manganese deficiency, and for this reason has often been grown on manganese-deficient soils, where, in the absence of manganese application, other cereals have repeatedly failed.

SYMPTOMS OF MANGANESE DEFICIENCY

The general appearance of deficient crops is very characteristic. Affected crops germinate quite well and for six weeks or so appear quite normal and healthy. From this time onwards, however, patches of the crop begin to assume a pale

yellowish-green colour. As the season progresses these patches become paler and at the onset of warm weather assume a wilted, drooping appearance. The whole patch may die.

These acutely-affected patches vary from a few square yards to several acres in extent. They are very irregular in shape but are clearly defined in outline. Often small clumps of healthy plants remain in the midst of wilted patches.

Fig. 3.—In these experimental plots, the dark strips show healthy, well-grown plants resulting from the use of manganese-superphosphate as a soil treatment. Plots sprayed with manganese sulphate are much inferior to those which received the soil treatment and only slightly better than those which received no manganese

Wheat, oats and barley all show leaf paling which begins on the lower leaves and extends gradually to the newer growth. The pale leaves become limp and soft to the touch and ultimately die. Such affected plants often carry quantities of dead and wilted flag, particularly at the base of the plant. In severe cases the whole plant dies and no head is produced. In less severe cases a very weak head is produced.

Oats, in addition, develop a very characteristic symptom of manganese deficiency. After general paling, the lower leaves, in particular, develop dead areas in the centre portions of the blade. These dead areas which are commonly straw-coloured, cause the leaves to bend over and collapse at this point while the two extremities of the leaf are still green. Close inspection of plants will often show these leaf symptoms even though severely affected, manganese-deficient wilted patches are not apparent. Thus a considerable yield reduction can occur where no deficiency symptoms are noted on casual inspection.

Areas affected by manganese deficiency are often erroneously thought to be due to "take-all"—a fungous disease. Manganese deficiency can be easily distinguished from "take-all" by its typical appearance, and by the fact that, unlike "take-all," it is confined to a characteristic type of gravelly soil, and by the fact that oats are severely affected. Oats are immune to the true "take-all" disease.

CONTROL OF MANGANESE DEFICIENCY

Manganese deficiency can be controlled by—

(1) Applied soil dressings of manganese.

(2) Foliage sprays with manganese solutions.

(1) **Soil Application.**—Soil applications of manganese are usually applied by using superphosphate in which manganese sulphate has been incorporated. It has been found that a soil application of 14 lb. of manganese sulphate per acre is quite satisfactory for most of our manganese deficient areas. The fertiliser companies now prepare a mixture which contains 28 lb. of manganese sulphate per bag (187 lb.) of the mixture. This mixture should be used at a rate of not less than half a bag per acre. Special mixtures may be obtained by arrangement with the fertiliser companies when a different ratio of manganese to superphosphate is required, as may be the case when it is wished to use a heavy dressing of superphosphate without increasing the manganese sulphate dressing.

(2) **Foliage Sprays.**—Manganese deficiency can also be cured by spraying the foliage with solutions containing manganese, which can be absorbed through the leaves. Low-volume spraying equipment suitable for this purpose can conveniently deliver about 10 gallons of solution per acre. Hitherto, this Department has recommended the use of a 2 per cent.

foliage spray (2 lb. of manganese sulphate in 10 gallons of water), but recent experiments on oats have shown that a 4 per cent. spray is more effective and does not injure the foliage. At least in the case of oats, it is therefore felt that on the more severely affected crops a 4 per cent. spray (4 lb. manganese sulphate in 10 gallons of water) at the rate of 10 gallons per acre, through a low-volume spray, should be used. Foliage sprays should not be applied when the foliage is wet from rain or dew, or when rain appears imminent.

The commercial manganese sulphate which is used for spraying has about 10 per cent. of impurities, many of which are insoluble in water. These insoluble impurities tend to block the fine nozzles of the spraying equipment. They may, however, be removed by mixing the material in a container, allowing them to settle, and then using only the upper liquid. Filtering through a fine filter such as calico before putting it into the spray equipment is an additional precaution which is well worth-while.

WHICH SHOULD BE USED—SOIL OR SPRAY APPLICATION?

Soil dressings of manganese applied with the superphosphate at seeding are very convenient and involve no extra operations. Furthermore, control by this method is very reliable and more effective than spray application. **It is therefore recommended that soil dressings be used on severely affected areas when the presence of the deficiency is known prior to seeding.**

Although spray applications may not effect as good a cure as soil dressings, there are occasions when this form of treatment is preferable. When the presence of the deficiency is unknown at seeding, or where affected patches are small and so scattered that large areas of unaffected land would have to be treated if soil dressings were used, foliage sprays can be very useful.

IS TREATMENT ECONOMICAL?

No matter whether soil or spray application is used, additional cropping costs will be incurred.

In the case of manganese superphosphate at 93 lb./acre the extra cost will be 12s. per acre.

For spraying a 4 per cent. solution of manganese sulphate at 10 gallons/acre, the extra cost will be about 2s. 6d. for the manganese sulphate and 6s. for application, i.e., a total cost of between 8s. and 9s. per acre.

Application of manganese superphosphate is therefore more expensive than spraying, but **the extra outlay is definitely warranted.**

Fig. 4.—Manganese-deficient barley. Note the limp, soft appearance and the dead lower leaves

Manganese superphosphate is easy to use, supplies manganese in the early growth stages when it is most needed, and gives greater grain yield increases than sprays.

Manganese sprays have a definite economic use where there are small isolated areas of the deficiency, or for land that only shows the deficiency in very dry years.

In conclusion it should again be emphasised that although a cost of up to 12s. per acre may be incurred in treating manganese-deficient soils, it will enable a very profitable crop to be grown in place of a complete failure. Therefore when

growing cereals on manganese deficient soils you cannot afford to omit manganese applications.

REFERENCES TO PREVIOUS WORK ON MANGANESE DEFICIENCY IN WESTERN AUSTRALIA

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MURESK AGRICULTURAL COLLEGE

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Parents are reminded that applications for 1959 admission to Muresk Agricultural College close on 31st December of this year. A preliminary selection of 1959 entrants is made after the Junior results are available in January, 1958.

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Full details of the College are obtainable from the Principal, Muresk Agricultural College, Muresk, W.A., or the Department of Agriculture, Perth.

PLANT DISEASES

BACTERIAL CANKER OF STONE FRUITS

By OLGA M. GOSS, B.Sc. (Hons.), Plant Pathologist

DURING recent years, bacterial canker, a very serious disease of stone fruit, particularly plums, has become more widespread and caused concern to orchardists. It has now been recorded from many stone fruit districts in this State, especially in trees up to ten years old, but it seems to be most damaging in the Karragullen-Pickering Brook district, where a number of young plum plantings have been almost wiped out.

The most obvious symptoms to the orchardist are the occurrence of split-like cankers, from which gum exudes, and a progressive death of the limbs of infected trees. Once established, the disease is very difficult to control and results in death of the tree so that introduction of the disease should be avoided. One of the main objects of this article is to acquaint growers with the symptoms so that planting of diseased stocks and subsequent spread by pruning, can be avoided.

GENERAL SYMPTOMS

To the orchardist, the first indication of this disease is usually the sudden death of a limb of a young tree—the limb either failing to shoot (Figs. 1 and 2) or dying while in full leaf (Fig. 3). If this limb is examined closely, split-like cankers will be seen, usually exuding gum (Fig. 4). The stem in this region appears flattened (see Fig. 5). The flattening is caused by the tissue beneath the canker failing to grow and develop as does the surrounding healthy wood. Callus tissue develops

Fig. 1.—Bacterial canker infection in a young plum tree. Note—dead branch on left and cankers on trunk region

around the diseased area, marking it off more distinctly. Such cankers and flattening often occur on the main trunk (Fig. 6). If the bark on these areas is shaved off, it will be seen that the bark in the canker region is dark orange to brown in colour and the wood beneath, brown; whereas in the healthy region, the bark is green and the wood creamy white. There is a distinct line of demarcation between diseased and healthy tissue (Fig. 7). Sometimes a sour fermented smell can be detected in the diseased bark.

Fig. 2.—Seven-year-old plum tree showing typical symptoms of bacterial canker. Note.—A dead branch has been removed (see cut end in fork of tree). A second branch has failed to shoot this season and a third branch (at back) is unthrifty

When a branch is completely girdled by the cankers it fails to shoot and soon dies. If it is only partially girdled however, any of the following effects may occur depending on the amount of healthy wood remaining—

(i) The branch may develop blossom only, which soon becomes blighted (see Fig. 8).

(ii) The branch may shoot normally but the growth soon withers.

(iii) The unthrifty growth may survive till the end of the season, in which case the foliage first assumes a pinkish colour and is rather sparse and rolled (see Fig. 9).

In all the above cases, dieback of the limb occurs when it is finally girdled. As the branches are usually infected in succession, the tree is gradually killed progressively limb by limb.

Fig. 3.—Seven-year-old plum tree showing typical symptoms of bacterial canker. Note—Branch at left of the picture had come into leaf and subsequently died. The dead leaves still hang on the tree for some time

Fig. 4.—Small branch showing cankers from which gum is exuding

When infection has been introduced by pruning cuts, small slit-like cankers exuding gum, develop just below the cut. The terminal buds usually shoot and then wilt and the shoots develop a brown to black colour on one side and exude drops of gum (see Fig. 10). The wilting shoot dries off rapidly, but with the advent of warm weather (which is unfavourable for the disease) new shoots may appear (Fig. 11). In the nursery, if infected buds are used, wilting of growth similar to that just described, occurs and is the most obvious sign of diseased nursery stock.

In some countries the disease causes shothole lesions on stone fruit leaves, but in Western Australia, this leaf attack has not yet been noticed, and the common

Fig. 5.—Close-up of portion of a branch showing flattening in relation to split-like cankers

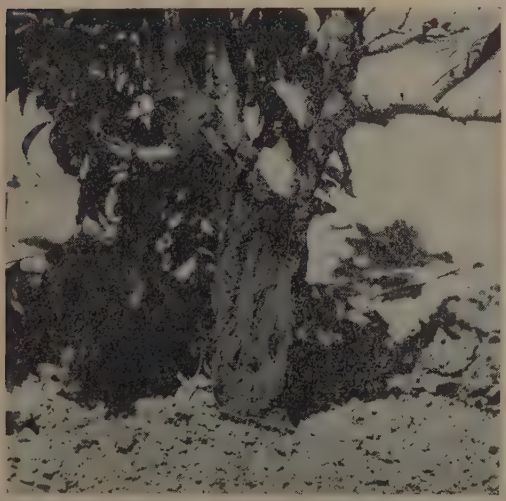

Fig. 6.—Trunk of an infected plum tree showing cankers and flattening of trunk

Fig. 7.—Trunk of tree shown in Fig. 6 with bark partially shaved off to show distinct line of demarcation between healthy and diseased tissue and discolouration of diseased wood

Fig. 8.—Close-up of an infected branch where blossom has appeared but has subsequently been blighted and withered. This photograph was taken when the remainder of the tree was in full leaf

Fig. 9.—Appearance of unthrifty foliage (left) compared with healthy foliage (right) to show stunting and malformation

"shothole" which occurs here, is due to a fungal parasite. No fruit symptoms, and no disease of the roots has been found in Western Australia. In most cases Myrobalan plum has been used as a rootstock, and even when the whole scion has been killed by the canker disease, the roots remain vigorous and send up vigorous healthy suckers (see Fig. 12).

CAUSE

The disease is caused by a bacterial organism *Pseudomonas syringae*. The organism is most active in the cooler weather, i.e., autumn, winter and early spring, and ceases its activity as the weather warms up. However, the effects of this winter activity (i.e., canker formation, etc.) may not be obvious until the summer, when the branches suddenly collapse, due to the cutting off of the sap supply.

HOST RANGE

Bacterial canker may attack all kinds of stone fruits but in Western Australia, it has so far caused most damage to plums.

Fig. 10.—Typical appearance of terminal shoots on a recently infected branch. Note discolouration of stem and withering of terminal leaves

Fig. 11.—Typical appearance of infected tip growth as weather becomes warmer. The infected tip has withered and new shoot growth is developing. Note—discolouration and gumming on one side of stem

The disease has also been recorded here on apricots.

SPREAD OF THE DISEASE

Primary infection centres result from planting diseased nursery stock. Secondary spread from these trees in Western Australia is mainly by pruning, but also occurs naturally during leaf fall. In the former case, an orchardist may prune an infected tree, when sap containing the disease organisms will be left on the secateurs. If he then passes on to a healthy tree, some organisms will be introduced at each cut, so infecting the previously healthy tree.

In the latter case, i.e., during leaf fall, tiny openings are left on the leaf scar which allow entry of the organisms which are spread by wind and rain. Any other injuries, e.g., mechanical, insect, etc., can serve as entry points for the disease.

CONTROL ASPECTS

1. The disease is generally introduced by planting diseased nursery stock. For this reason nurserymen or others engaged in propagation should ensure that only buds from healthy vigorous older trees are used in propagation. If subsequently however, any wilting of top growth occurs, as described above (Figs. 10 and 11), the "worked" trees should be pulled up and destroyed.

2. During pruning, take precautions to avoid spreading the disease by disinfecting the secateurs in a 2 per cent. formalin solution (made by mixing 1 part of commercial formalin with 49 parts of water) after pruning each tree. (If practicable, use two pairs of secateurs, alternating their use). As a further precaution, it is advisable to leave any trees showing symptoms of disease until all apparently healthy trees have been pruned.

3. If it is necessary to remove whole dead limbs or large sections of wood, do so during the warm months, when the disease is not active. Any large cuts should be smeared over with a paste of streptomycin in Lanolin—made by mixing streptomycin sulphate powder (approximately 2 grammes) into a large tube of Lanolin.

4. Spray experiments on the control of this disease are not yet concluded, but they have progressed sufficiently for the

Fig. 12.—Typical appearance of a young tree killed by bacterial canker. Note—proliferation of growth from the root stock—the scion having been completely killed

following tentative recommendation to be made.

During leaf fall, give two to three sprays, at approximately weekly intervals, of streptomycin sulphate plus glycerine at the rate of ¾ oz. of streptomycin, ½ gallon of glycerine in 50 gallons of water. Cuprox for the control of shothole may be mixed with this spray.

Streptomycin sulphate is available in two forms—

(a) the pure sterilised material as used for human injection;

(b) the same chemical unsterilised for horticultural purposes.

It was the latter material which was used in these experiments.

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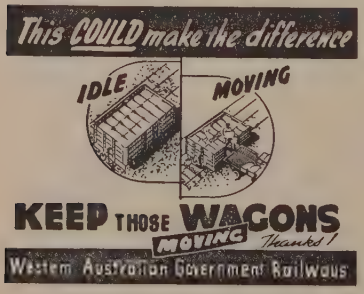

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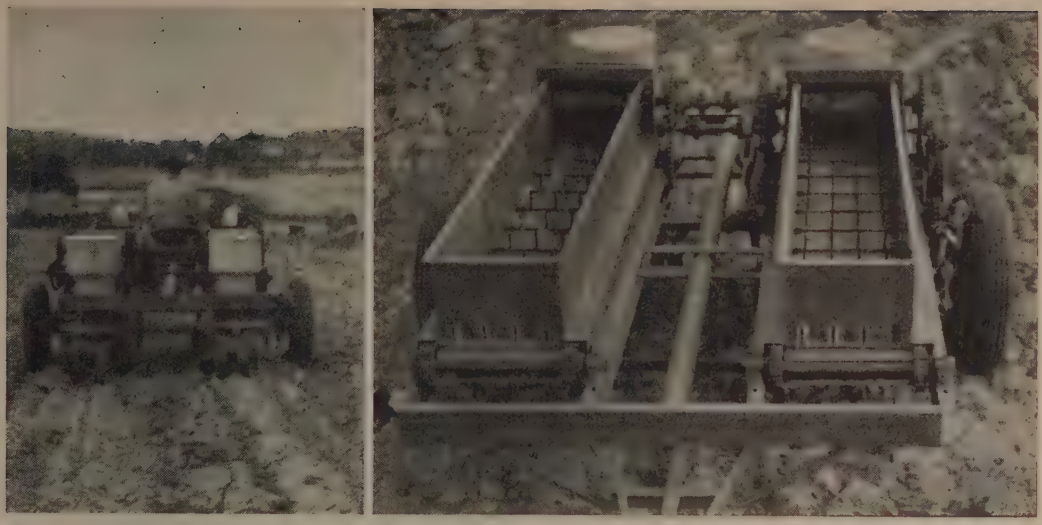

Fig. 1.—Two views of the Bermuda sprig planter

KIKUYU GRASS PLANTING BY MACHINE

By F. E. RYAN, B.Sc. (Agric.), Agrostologist, and J. A. CARBERRY, B.Sc. (Agric.), Agricultural Adviser

THE value of Kikuyu grass as a pasture plant is known to most dairy-farmers. It is deep-rooting and capable of good autumn, late spring and—in summer moist areas—all-year-round production. It is valuable on sandy soils even in the drier dairying districts, is palatable to stock and can withstand heavy grazing.

The main disadvantage of this plant is that is cannot be sown from seed and therefore the establishment of any substantial area involves very laborious hand-planting. A Bermuda sprig planter was introduced from America and tested in the South-West of this State with good results and some details concerning this work will be of interest to dairy farmers.

THE MACHINE

This machine automatically plants sprig grasses such as couch and Kikuyu. The unit opens up, fertilises, covers and packs the furrow. Two rows of sprigs may be planted at any distance apart, between 32 in. and 40 in. centres. Two troughs on top of the machine hold the sprigs. A shovel type of share opens the furrows while spiked conveyors pull sprigs into the feeder. A distributor breaks and separates the sprigs and a chute guides them into the furrow. Fertiliser is then dropped into the furrow which is covered by small disc cultivators immediately behind the chute.

The machine was originally designed for Bermuda or couch grass, but appears to be adapted to the use of Kikuyu.

In practice, trials with this machine have covered several situations, including sowing of Kikuyu grass in virgin soils, in cultivated soils, in uncultivated grassland paddocks and in bracken infested areas.

VIRGIN SOILS

The machine was found to work very satisfactorily on this type of country, providing it is reasonably free of roots and stones. Kikuyu was planted readily in these situations and the rate of planting was approximately 10 to 12 acres in one eight-hour day. On newly-cleared land,

Kikuyu grass can be readily established with this machine and, with the development of subterranean clover pasture on the area, a mixed clover-Kikuyu grass pasture can be developed fairly quickly. On such areas the sprig planter has distinct possibilities.

CULTIVATED AREAS

In using the machine at Manjimup, Denmark and Walpole, it was found that it worked very efficiently on land which had been previously cultivated. The plough share opened up a small furrow, planted the grass roots and the small disc cultivators replaced the soil in the furrow before rolling. No difficulty was experienced in planting areas which were in this condition. This was also found to be the case where a bush-and-bog disc cultivator was used to chop down ti-tree regrowth in a previously cleared paddock. Following the cultivation, the sprig planter successfully operated in planting Kikuyu roots. From this trial it is clear that the machine will be of considerable value in establishing areas of Kikuyu grass, providing prior cultivation can be carried out.

UNCULTIVATED GRASSLAND PADDOCKS

The possibility of introducing Kikuyu grass into the existing clover-grass pasture was considered at both Manjimup and Denmark. It was hoped that the machine would prove satisfactory in planting Kikuyu sprigs into the existing field without the necessity of cultivating the established clover-grass pasture. In both instances, it was found that the machine as designed, was not efficient in carrying out this work. The opening plough share threw the sods too wide for the disc cultivators to return the soil to the furrow after the sprig had been planted and where planting was arranged in such a paddock the sprigs were not covered by soil as the machine passed over.

Modifications were made to the machine in the form of leading coulters, smaller furrowing hoes and a baffle board designed to prevent the hoe throwing the sods too wide but this failed to overcome the problem. So far no satisfactory method has been devised of using the machine to introduce Kikuyu roots into existing pasture swards without prior cultivation of the area.

BRACKEN-INFESTED AREAS

The possibility of introducing Kikuyu grass into bracken-infested areas with the idea of choking out the bracken by the growth of Kikuyu, presents interesting possibilities. If Kikuyu grass can be established in this situation and animals encouraged to forage for the Kikuyu grass, their trampling will assist in bracken control and eventually the Kikuyu would be expected to choke out much of the bracken. In practice, this appears to be a possibility only after tall-growing bracken has been reduced by means of rolling and to such an extent that light will be allowed into the Kikuyu grass.

Fig. 2.—Raking up Kikuyu grass sprigs after using the bush-and-bog cultivator

One attempt was made with the sprig planter to plant a bracken-infested area, but the heavy bracken fouled up the machine and the attempt was not successful. It is expected that on bracken which has been rolled for several years, and reduced in vigor by that means, it should be possible to plant Kikuyu grass among it.

AREA PLANTED

At Manjimup the area planted in the spring of 1956, was approximately 20 acres and in the Denmark-Walpole district an area of approximately 160 acres has been planted with this machine. Reports concerning establishment have been good and it appears that this type of planting has been quite efficient in establishing the grass.

SUPPLY OF ROOTS TO THE MACHINE

The supply of roots to the machine must be maintained by rotary hoeing a Kikuyu grass paddock, gathering the roots and loading them into the troughs on the machine.

At Manjimup roots were lifted following rotary hoeing and the mechanism successfully teased out the roots and fed them through the chute. It was found however, that the roots were best taken from a sandy area rather than a heavier soil type. In the sandy area, long roots were available and they were freed of adhering soil quite readily. Roots taken from heavier soil types were shorter in length and sods were lifted up which did not tease out readily. In the Denmark district the most efficient means of obtaining roots was by means of a bush-and-bog cultivator. Again Kikuyu grass taken from lighter soil types was found to be more efficient in the machine.

To date, trials with this machine have been most promising and indicate that it will be very valuable for sowing Kikuyu in the lower South-Western districts of the dairying areas of Western Australia.

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FEEDING STUFFS FOR LIVESTOCK

A GUIDE TO THE COMPOSITION OF STOCK FEEDS GROWN IN WESTERN AUSTRALIA

by

L. C. SNOOK, D.Sc., Animal Nutrition Officer

INQUIRIES are often received concerning the relative values of various feeding stuffs. It is not always easy to answer these questions as the quality of most foods can be affected to a marked degree by the environment and the stage of maturity when the material is harvested. At times, however, it is important to have a guide to the composition of a feeding stuff. Particularly is this so in times of stress when fodder reserves have to be used to maximum advantage, or when supplements have to be purchased. A table has been prepared, therefore, which shows the composition of typical samples of the more common foodstuffs. These will serve for the calculation of balanced rations and also to determine which of several foods is best suited for a particular purpose.

Brief comments on the headings used in the table may be helpful.

ENERGY VALUE

For most practical purposes the "Energy Value" or "Starch Equivalent" is the best yardstick with which to measure the value of a foodstuff. Many factors have to be considered when feeding stuffs are being purchased. In most cases, however, the livestock owner is seeking a palatable food which provides "energy" at the lowest cost. If other nutrients such as protein, or calcium, or phosphorus are of major concern, then the table can be used for these constituents specifically.

CRUDE PROTEIN

Protein is essential for the maintenance of bodily tissues, for growth, reproduction and lactation. Protein-rich foods are expensive to buy and farmers should endeavour to grow and conserve foodstuffs with an adequate protein content. Young growing pasture, for example, is rich in protein and hay made from crops cut as early as is practicable can be valuable sources of protein. It is both interesting and important to appreciate that cereal grains grown in the Eastern Wheatbelt characteristically have a much higher protein content than grains of the same variety grown in areas of higher rainfall. Leguminous seeds, in contrast, have much

WEST AUSTRALIAN FOODSTUFFS.—A GUIDE TO THEIR COMPOSITION

Foodstuff	Energy Value per 100 lb.	Components as a Percentage of the natural material			
		Total Protein	Fibre	Calcium as Ca	Phosphorus as P
Cereal Grains—					
Wheat	72	10	2	0·04	0·22
Barley	71	8	5	0·05	0·22
Oats	60	8	13	0·05	0·22
Leguminous Seeds—					
Peas	70	22	5	0·08	0·36
Vetches	65	27	4	0·10	0·40
Lupins	70	31	18	0·14	0·36
Hay—					
Wheaten or oaten hay	40	6	27	0·10	0·14
Meadow hay	40	12	27	0·60	0·25
Clover hay	40	18	20	1·20	0·25
Lucerne hay	40	18	27	1·20	0·25
Mill Offal—					
Bran	65	13	8	0·10	0·60
Pollard	75	13	5	0·05	0·40
Protein - rich Concentrates—					
Linseed meal	72	30	8	0·40	1·10
Dried buttermilk	80	30	....	1·00	0·90
Dried separated milk	80	30	...	1·00	0·90
Midland meatmeal	75	50	2	1·80	3·50
Whalemeal	75	60	1	4·50	8·00
Dried whale solubles	75	82	....	0·50	1·00
Silage—					
Wheat, oats or grasses	14	2	12	0·06	0·08
Mainly clover	14	5	10	0·30	0·08

Note.—With the exception of silage, all the above foodstuffs contain about 10% moisture. Silage contains about 70% moisture.

the same protein content wherever they are grown.

In the prepared table the values for "crude" protein have been recorded, rather than the amount of digestible protein. This has been done because most of the information available to the farmer gives "total" or "crude" protein rather than the amount which is digested by the animal. For making comparisons the figures as listed are probably more useful.

CALCIUM

An adequate intake of calcium (lime) is essential for the continued good health of animals. It is important, therefore, to consider the calcium present in the available foodstuffs. Pigs or poultry, for example, are often fed mainly on cereal grains which contain very little calcium. Unless lime is added to these cereal rations serious economic loss can result.

In the field, fortunately, grazing animals seem to be able to obtain sufficient calcium. Leguminous plants and capeweed contain considerable lime and in the "clover areas" there should be no shortage of this element. Even in the Eastern wheatbelt where the dry feed is mainly cereal in nature, no evidence of calcium deficiency among grazing animals has been received. But where animals are hand-fed, or confined to restricted areas, the possibility of calcium deficiency should be kept in mind.

PHOSPHORUS

Phosphorus is of vital importance to all living cells and deficiencies of this element can have serious consequences. Green herbage should supply sufficient phosphorus to grazing animals but as plants mature, the phosphorus content shows a marked fall. For this reason dry mature herbage is unlikely to contain sufficient phosphorus for maximum growth or milk production. Cereal grains grown in Western Australia contain only about half as much phosphorus as is found in similar seeds overseas. Mill offal in turn contains less phosphorus than is commonly assumed. Cattle in particular have high phosphorus requirements and farmers should be alert to the possibility that phosphorus supplements may be needed during the dry summer months.

General.

The first essential in a foodstuff is palatability. Too much emphasis cannot be given to the importance of supplying food which stock enjoy eating.

The fact that foodstuffs vary considerably in food value should also be kept in mind. There can be much more difference, for example, between two samples of wheaten hay cut at different stages of maturity than between hay made from quite different species cut at the correct time.

ACTINOBACILLOSIS *("Lumpy Jaw")* IN SHEEP

By F. C. WILKINSON, B.V.Sc., Government Veterinary Surgeon

ACTINOBACILLOSIS, or "lumpy jaw" as it is commonly called, is a disease which causes multiple abscess formations in the soft tissues of the head and neck of sheep, particularly around the lower jaw.

The disease has been reported from all States of Australia and is believed to be fairly common in West Australian flocks. Because it seldom occurs in epidemic form and usually only affects a few sheep in a flock, many cases are not reported and it is difficult to assess the overall incidence.

Recent investigations on one property revealed a number of cases however, and shearers reported that similarly-affected sheep were commonly encountered in the district during the summer crutching.

CAUSE

The disease is a bacterial infection caused by the micro-organisms, *Actinobacillus lignieresi.* These bacteria do not appear to penetrate sound tissue, but enter the system through skin wounds or minor injuries to the lining of the mouth. Many infections in this State appear to originate in injuries caused by grass seeds.

SYMPTOMS

Having gained entry, the bacteria multiply rapidly and cause a number of small hard nodules to form in the soft tissues. These develop into abscesses up to three inches in diameter, many of which burst and discharge greenish-yellow pus.

The abscesses may eventually become hard fibrous swellings which, if present in large numbers, may cause malformation and fibrosis of the jaws, making it difficult for the animal to feed. Marked loss of condition, or even death from malnutrition can result from this development.

Mortalities have also resulted from interference with breathing caused by the pressure of large abscesses on the throat.

The abscesses are formed in the soft tissues of the cheeks, nose, lips and throat and may extend to the lymph nodes of the neck. On post-mortem examination they will be found to be enclosed in thickened fibrous capsules.

Another symptom which may or may not accompany the abscess formation is a nasal discharge of "ropey" whitish fluid. On post-mortem examination, a quantity of this fluid will be found in the nasal cavity, and the mucous membranes lining the cavity will be seen studded with raised white patches or pustules containing greenish-yellow pus.

Sheep with the nasal discharge will experience difficulty in breathing. They will tire easily and lag behind the flock when driven.

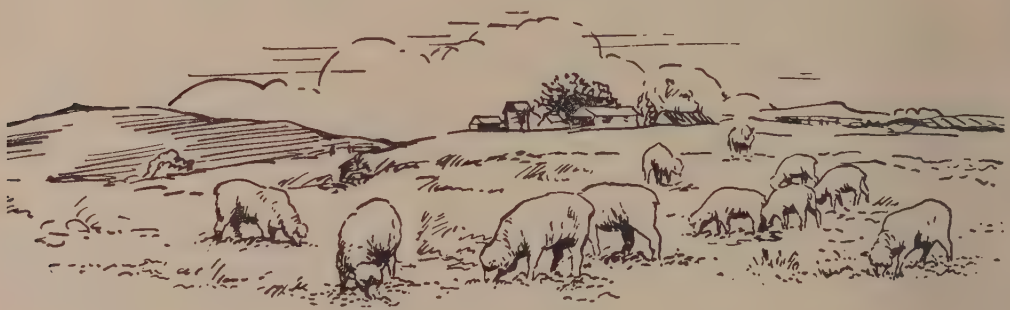
TREATMENT

For the treatment of affected animals a solution of sodium iodide is recommended.

It is given as a subcutaneous injection (under the skin), in doses of 30 ccs. of a 10 per cent. solution in water. Treatment should be given once a week and carried out for four or five weeks.

Recovery is not dramatic, and no change may be seen till after the series of weekly injections has been finished. There will be a reduction in the size of the abscesses, which will resolve to leave small fibrous lumps under the skin.

As the affected sheep usually cannot readily obtain food, due to the painful lesions, it is advisable to hand-feed the animals during treatment. This will assist the nutrition and general health of the sheep—so increasing the likelihood of complete recovery following treatment.



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POISON PLANTS OF WESTERN AUSTRALIA

By C. A. GARDNER, Government Botanist

EVERY year, losses of stock amounting to thousands of head, occur in Western Australia as the result of grazing on poisonous plants. Sometimes the losses are associated with unusual seasonal conditions; sometimes heavy mortalities occur among hungry travelling stock, or among stock depastured on newly-opened country.

It is not easy to define a poison plant exactly. Some are plants which constantly contain one or more toxic principles. These are the well-known poison plants which can readily be identified and which may be avoided or eradicated.

On the other hand there are certain plants which are usually regarded as good pasture or fodder material, but which, under certain conditions may contain dangerous quantities of toxic substances. It is well known that sorghum may contain prussic acid in sufficient quantities to cause stock mortalities; the well-known pasture grass *Phalaris tuberosa* may induce a condition known as "phalaris staggers"—usually during a vigorous growth of the grass following rain after a dry summer. A very similar condition may follow the ingestion of ryegrass where this grass is dominant in a pasture.

Other plants, widely accepted and used as good pasture or forage plants, can cause serious mortalities if taken as the dominant diet over a long period—as for example the subterranean clover or the so-called West Australian blue lupin.

Some plants contain pigments which, when eaten, cause animals to become abnormally sensitive to sunlight—the condition known as photosensitisation. Others have a local irritant effect on the skin inducing a form of dermatitis.

Finally, there are those plants which cause a purely mechanical damage and may affect the health of the animals to a serious degree. They are not, strictly speaking, poisonous plants but they cannot be overlooked. The seeds of the common stinkwort may cause damage to the bowels, increasing the liability to entero-toxaemia; the seeds of sorghum may cause internal punctures, while plants with "flannel-coated" foliage or those containing tough fibres may cause sickness and even death by the formation of "fibre balls" in the digestive tracts of horses, cattle and sheep.

VARYING TOXICITY

The toxicity of a plant may vary considerably according to the environment—especially the soil; the variety of the species; the stage of growth, and the parts of the plant that are eaten.

The well-known poison plants of South-Western Australia are much more virulent when in flower, in seed, when young, or when making new growth after the first rains, than they are at other times.

Pituri may contain nicotine in dangerous quantities or it may contain nornicotine, according to the locality in which it is grown. In its marginal areas in Western Australia it contains nicotine; in the centre of Australia it contains nornicotine and on the Eastern Goldfields it contains both.

The effects of the plants on different animals is another factor. The Birdsville Indigo, for example, is poisonous to horses but appears to be harmless to cattle and sheep. The Crotolaria which causes "Kimberley Horse Disease" apparently only affects horses.

Box poison is fatal to horses, cattle and sheep and it is safe to assume that its seeds are poisonous to these animals, yet bronzewing pigeons eat the seeds freely without ill-effects. Nevertheless dogs

have been poisoned by eating the entrails of bronzewing pigeons which have been shot.

PALATABILITY

Some poison plants are not readily eaten by stock, but hungry animals, from distant localities where the plants are seldom encountered, may eat sufficient to cause death.

The native tobacco plants, which contain dangerous quantities of nicotine, do not appear to be liked by stock and the same applies to the Cape tulip which is rarely eaten by stock reared in places where these weeds are common.

The balsams—one of which, the so-called "Gascoyne Poison," has probably been responsible for the heaviest stock losses of any of the West Australian plants—are usually disregarded by pasturing animals but cause serious mortality among hungry travelling stock.

The effects of many of the plant poisons are accentuated if the animals are driven or in any way disturbed or excited. Where it is suspected that poison plants have been ingested, the stock should be rested. In some cases, the effects of plant poisoning may become evident after the animals have been watered.

TOXIC PRINCIPLES

The toxic principles of poison plants may be classified chemically as alkaloids, such as strychnine, nicotine or nornicotine found respectively in the strychnine bush, tobacco and pituru; as glucosides, notably the cyanogenetic glucosides which give rise to prussic acid poisoning; as toxalbumins such as ricin which occurs in the castor oil plant; as mineral poisons such as oxalic acid (found in rhubarb leaves, soursob and certain species of parakeelya) or selenium which may be taken up from the soil in dangerous quantities by certain plants. In some plants the toxic principle is unknown, and this is true of the common pea-flowered poisons belonging to the genera Gastrolobium and Oxylobium.

Perhaps the most puzzling of all are those plants which under certain conditions contain prussic acid. The number of these is quite considerable. The glucosides in these plants are not poisonous in themselves but in the presence of appropriate enzymes are broken down giving free prussic acid which is highly toxic. The amounts eaten and the rate of consumption are also important.

Some plants normally contain cyanogenetic glucosides, but in others they occur only under certain conditions, of which climate appears to be the most important. Wilting, or damage due to frost, disease, insects, or mechanical damage are also important. Periods of rapid regrowth such as those caused by rain after a period of drought are particularly favourable to toxicity. The appropriate enzyme may be present in the plant containing the corresponding glucosides or it may be present in a totally different plant, in which case it would be necessary for the animal to eat both plants for poisoning to occur, especially in non-ruminant animals. In ruminants, on the other hand, the cyanogenetic glucoside may be hydrolysed by the ruminal contents without the presence of enzymes in the herbage ingested by these animals. Since prussic acid is rapidly excreted by the animal, no poisonous effects will be produced unless the rate of absorption exceeds that of excretion, and thus it is that plants like the Gascoyne poison cause mortalities amongst hungry travelling stock, whilst those depasturing in the area are rarely affected.

SOME POINTS ON USING WEED SPRAYING EQUIPMENT

By
G. R. W. MEADLY,
Officer-in-Charge,
Weeds and Seeds
Branch

THE first spraying of cereal crops in Western Australia for the control of weeds was undertaken in 1950. Within three years the area treated reached 300,000 acres and spraying operations for weed control are now regarded as a routine procedure on a large number of wheat farms.

This rapid increase in the use of chemicals for weed control was due largely to the discovery that hormone-like substances, including 2,4-D and M.C.P.A., destroyed plants such as wild turnip and wild radish without affecting the cereal with which they were growing. The spectacular progress would not have been possible, however, without the development of spraying equipment capable of applying an even coverage to the herbage with relatively small volumes of solution.

Prior to the advent of hormone-like herbicides a number of other chemicals had been used, particularly in Europe, the usual rate of application being about 100 gallons of solution per acre. Although inconvenient, it was practicable to use such amounts with relatively small acreages of high yielding crops. Under Australian conditions with large areas and much lower average yields, both practical and economic difficulties arose with such volumes. As the new chemicals readily formed solutions or emulsions and in most cases less than 1 lb. was required to treat an acre, agricultural engineers immediately explored the possibilities of reducing the volume of solution applied. By modifying the nozzles and reducing the

Fig. 1.—A trailer unit with a 30ft. low-volume boom spray towed by a four-wheeled-drive vehicle

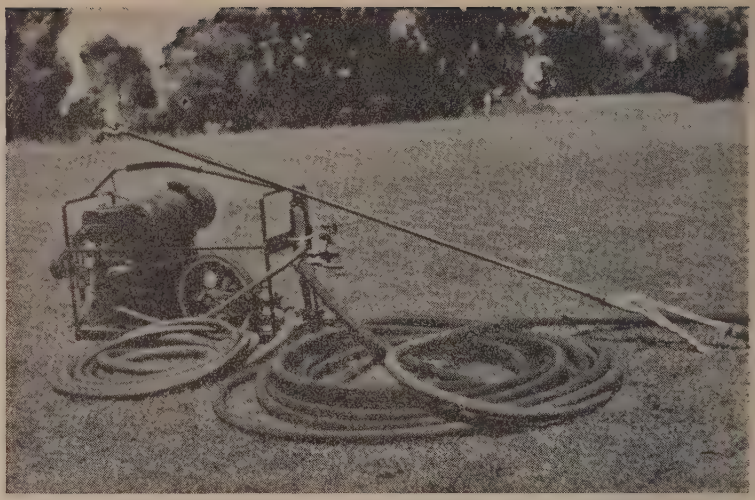

Fig. 2.—A small engine-operated unit fitted with spraying lances

pressure it was found possible to obtain an even and effective coverage with less than ten gallons per acre. Most of the weed spraying in Western Australia is being undertaken with 6-8 gallons per acre.

Ten years ago 4 oz. of active chemical in 6 gallons of water spread effectively over an acre of crop would have been regarded as a tall order. Now it is commonplace, often to the extent of farmers becoming somewhat careless regarding applications. When using such small quantities the work must be done accurately and the equipment given every care if good results are to be maintained.

The first job is to calibrate the spraying unit. A chart is usually supplied by the manufacturers but it is advisable to check the output both initially and as the work is proceeding. The quantity of solution being applied per acre is dependent on the length of the boom, the size and number of the nozzles, the pressure and the speed at which the unit is travelling. The boom and nozzles can be regarded as constant at the time of any calibration, the two variables being the pressure and the ground speed. Most low volume spraying is undertaken at 25-30 lb. per square inch of pressure and booms are constructed to apply approximately 8 gallons per acre at five miles per hour.

A 30ft. boom with an effective span of 33ft. travelling at five miles per hour will spray one acre in three minutes. The quantity of solution passing through the boom in three minutes is therefore the volume being applied per acre when moving at that speed. This volume can be checked when the equipment is stationery and rechecked under operating conditions. As the work is proceeding the area covered with each tank of solution should be calculated from time to time.

Once the rate of application has been defined, it is important to maintain a constant pressure and ground speed. An increase of 10 lb. in pressure raises the rate of application by about 10 per cent. while an increase of one mile per hour reduces it by 20 per cent.

Blocked nozzles can be very annoying and time absorbing but unless cleaned promptly will result in uneven weed control. Clear water should be used whenever possible and filters kept clean. Care should be taken when removing obstructions not to increase the size or alter the shape of the nozzle opening. Metal probes are likely to do this. When replacing the nozzle it should be adjusted so that the fan spray overlaps that from the adjoining nozzles. By this means, with the boom set at an appropriate height, usually about 2ft. from the ground, the weeds receive a double coverage of spray.

Attention to equipment is equally important when spraying has been completed for the season. All nozzles should

be removed from the booms and cleaned, while the boom itself should be flushed thoroughly with water followed by a quick run through with a light oil. The tank and connections should also be drained and flushed. Little attention is then required when the unit is next used.

One final note of warning. Although 2,4-D is not poisonous the ester type in general use is quite volatile and with higher temperatures vapour may be formed. Spraying equipment, therefore, should not be stored near gardens or susceptible crops, tomatoes and grapevines being particularly sensitive.

(From a Country Hour broadcast. By courtesy of the Australian Broadcasting Commission).

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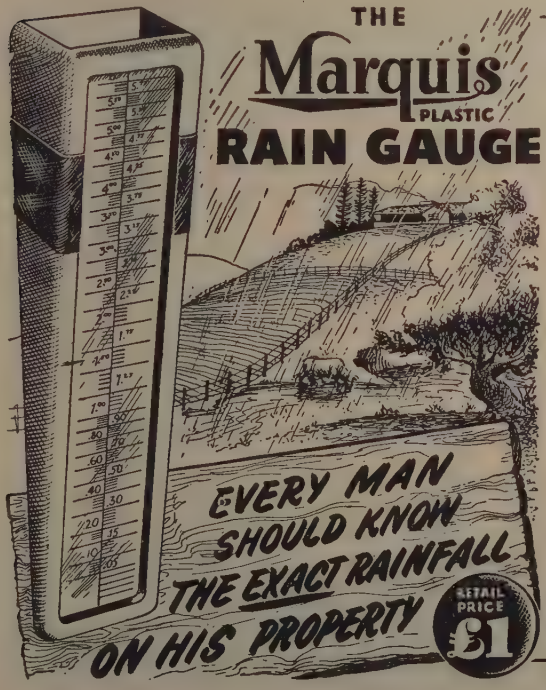

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FARM PLANNING

Fences and Soil Conservation

By B. a'B. MARSH, Adviser, Soil Conservation Service

Salt land can grow something or nothing. Well-timed grazing is impossible without well-planned fences and water supplies

ON any wheatbelt farm it is easy to see the need for planning fences for future convenience. Without planning, fences can cause erosion, interfere with erosion control and prevent good stock management. A neat layout of straight fences on clean white paper can be transferred to hilly land to become a nightmare of narrow corners, eroding gateways, boggy and rutted wheeltracks, unsafe cultivation on paddocks which are either overgrazed or undergrazed. After 50 years of frustration waiting for the fence to fall down before it can be replaced, it is surely amazing that even now fences are being replaced along the old fence lines.

Fences can cause erosion because they are permanent features of a landscape and cause cultivation, tracks and firebreaks to be in certain places and to travel in certain directions. If the fence is in the wrong place, so are the tracks, firebreaks and cultivation.

It is possible to plan the fences so that they do not cause erosion, but to do this, the position of the fence has to bear certain relationships to the slopes and natural features.

Fences can interfere with erosion control when placed with little regard to the natural creeks and rocky ridges. Contour working is impossible where fences and rocky ridges or creeks enclose small portions of awkwardly shaped land. Contour banks to help reclaim eroded land cannot conveniently be taken through fences; some fences, therefore, make contour banks impossible. Contour working is often inconvenient when confined by straight fences not situated well with respect to the slope of the land, This

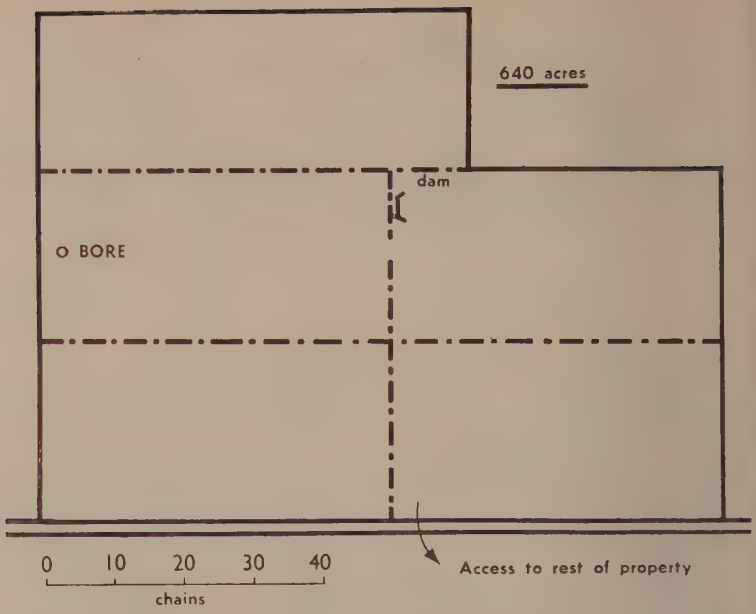

Fig. 1.—Typical fence system

does not mean that a well-planned farm will have contour fences; it is more usual to have the fences placed along natural boundaries, down ridges and along watercourses

As the normal farm has developed in the past, the fences have been placed along survey boundaries or their position has been determined by the pattern of the clearing, presence of poison, etc. Now that those farms are developed it is possible to see that the fences are not related to topography and convenience.

Most farms are divided into natural clear cultivation areas by a combination of creeks, watercourses, gullies, grassed

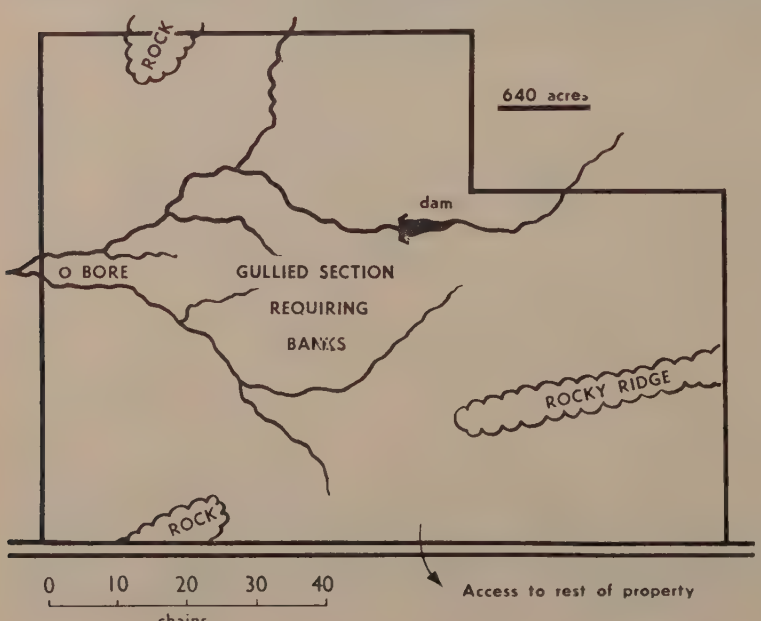

Fig. 2.—Gullies and rocky ridges also divide the farm into irregularly-shaped areas

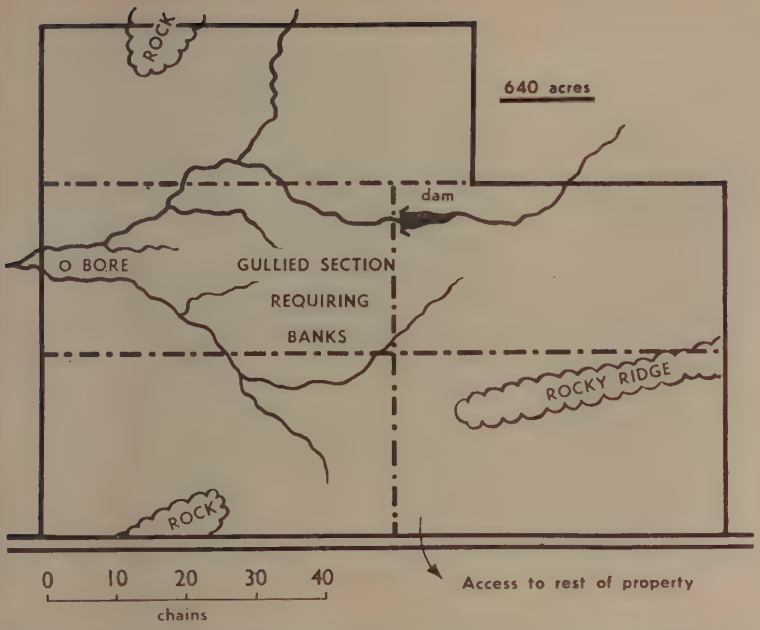

Fig. 3.—Fences plus natural features create cultivation problems

waterways, rocky ridges, trees left for shade and surveyed roads and farm boundaries. As if this isn't enough, most farms are further subdivided and complicated by fences which cut across these natural paddocks.

This diagram shows a typical paddock layout on a 640 acre portion of a farm. The arrangement looks simple and convenient. (Fig. 1.)

A map of the same farm showing the natural features, shows irregularly shaped

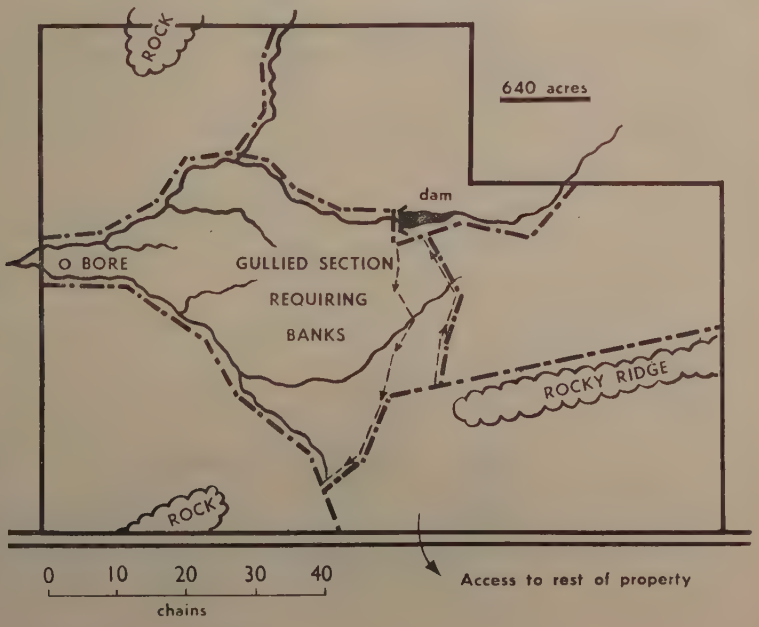

Fig. 4.—Fences planned to follow the natural features, where possible, with facilitate erosion control measures

areas bounded by creeks and rocky ridges. These can be cultivated round and round or on the contour without much inconvenience. (Fig. 2.)

Usually the natural layout and the superimposed conventional layout divide the farm into many inaccessible, awkward shaped, small bits of land. The use of contour banks, if they are necessary or become necessary, is made difficult or impossible. (Fig. 3.)

It is possible to fence along natural boundaries providing other factors are also considered. If this farm is fenced by natural boundaries the arrangement is at once less complex and water supplies which often occur on natural boundaries immediately become more efficiently used. The number of boundaries and therefore the number of erosion hazards immediately becomes less. Usually enough latitude is allowed to divide the farm into nearly equal sized paddocks. The centre area in this case, can be divided not by a natural boundary but by a contour fence along a proposed bank line. (Fig. 4.)

Other factors, of course, must be taken into account but much hard thinking is eliminated.

The suggested method of planning which will be explained in future articles, is essentially planning on paper so that all factors can be considered and so that the record is always at hand to peruse over the period of implementing the plan, a matter of 10 to 20 years. Such a plan should be able to survive change of ownership and even major changes in farming practice.

The next article in this Series will be entitled "Fences for Efficient Grazing."

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Fig. 9.—Typical appearance of chicken suffering from coccidiosis.

HOUSEHOLD POULTRY-KEEPING

(continued)

by

R. H. MORRIS, Officer in Charge Poultry Branch;

R. VAGG, Poultry Instructor;

and

M. W. G. CRITCHELL, Poultry Inspector

COMMON AILMENTS OF DOMESTIC POULTRY

IT is not proposed to deal fully with the diseases of poultry in this article, as complete information on the various diseases is available in pamphlet form free on application to the Department of Agriculture. However, a brief outline of the more common ailments of the domestic fowl is given.

COCCIDIOSIS

In preventing coccidiosis (a disease caused by micro-organisms called *Coccidia*) good sanitation and cleanliness are of vital importance. A natural immunity can be acquired by a flock that is exposed to only a small amount of infective material, whereas if the concentration of infective bodies is allowed to build up beyond a certain level, heavy mortality can result. In particular, dampness should be avoided as the disease thrives in moist conditions.

There are several species of *Coccidia* which infect chickens—all attack the lining of the intestine, but each species tends to favour a particular area. Among those most commonly encountered is one that attacks the caeca (the blind sacs near the lower end of the intestine) causing what is known as caecal coccidiosis, and another species which attacks different parts of the intestine, in which case the disease is referred to as intestinal coccidiosis.

The symptoms of both caecal and intestinal coccidiosis are rather similar. Affected birds show a loss of appetite, appear depressed and stand with feathers ruffled.

With **Caecal Coccidiosis,** which usually attacks birds from six to eight weeks of age, blood will appear in the droppings in most cases.

In **Intestinal Coccidiosis,** which usually attacks birds from 12 to 14 weeks of age, blood is seldom seen in the droppings, but the birds are very anaemic and pale about the face, comb and wattles.

Present-day poultry keepers are fortunate to have at their disposal two very effective drugs which, when used in conjunction with good management, can be relied upon to achieve good results in controlling coccidiosis.

Sulpha-quinoxaline and nitrofurazone are the two drugs in common use at the present time, and these should be used to prevent and control an outbreak of this disease. Full instructions are given in the

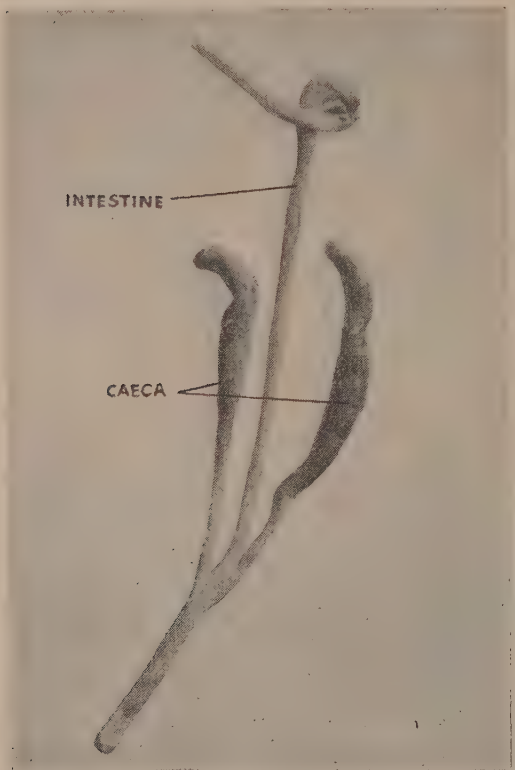

Fig. 10.—Caecal coccidiosis. Both caeca are distended and filled with blood.

literature that accompanies each container. At the preventive level, these drugs can be fed through the mash, but to control an outbreak, intermittent medication through the drinking water is preferred. A sick bird will usually drink, but will rarely eat.

Good management plays an important part in preventing and helping poultry to recover from most diseases and in no other disease is this better illustrated than in the disease coccidiosis.

Reference has already been made to the importance of good sanitation in preventing the coccidia from building up to lethal concentrations in the ground and litter.

Once the chickens become affected, medication of the drinking water should commence and care must be taken to see that the chickens are comfortable at night. If the disease strikes at about the six-week-old stage when the heat of the brooder is usually taken away, artificial heat should be maintained or returned for a few days until the chickens have recovered. The chickens should then be taught to perch as soon as possible using a perching platform. The longer they are allowed to congregate together and sweat on the litter after the brooder is dispensed with, the greater the possibility of coccidiosis causing serious trouble and of healthy chickens becoming unthrifty.

If newly-purchased, started chickens have not been taught to perch by their previous owner, the householder should concentrate on this important aspect of management until all the birds are perching. The first step is to make the chickens sleep on a slatted platform which is raised a few inches from the litter. If low perches are then placed above the platform, the chickens will usually move on to them. All chickens should be perching by the nine-week-old stage.

FOWL POX

This is a disease that can be disastrous, causing mortality sometimes as high as 75 per cent. Not only does it cause heavy mortality but birds affected with fowl-pox are slowed down in reaching the lay, sometimes by as much as eight weeks and if laying birds become severely affected egg production will cease.

Fowl pox manifests itself in three ways viz:

1. **Eruptive Type.** This is indicated by sores and wart-like growths which appear on the face, comb and wattles.

2. **Diphtheritic Type** (Canker). In this type of fowl-pox yellow sores form in the mouth and throat, and may reach down to the wind pipe, in which case birds may die of suffocation.

3. **Oculo-Nasal Type.** The nostrils and eyes discharge a yellow pus and in severe cases the eyes may become greatly distended.

Fig. 11.—A severe case of the eruptive form of fowl-pox.

Fowl-pox can be prevented by vaccination in the 12th week of the bird's life. The method of vaccination is quite simple; a two-pronged needle being supplied with the vaccine. After following the mixing instruction given on the packet, the needle is dipped into the vaccine and is then pushed through the web of the bird's wing care being taken not to rupture any of the small veins in that area. The vaccination can also be given on the outside of the bird's thigh.

Approximately ten days after vaccination, a check should be made for "takes" which show as eruptive scabs that form around the site of the vaccination. Successfully vaccinated birds have a life-long immunity to the disease.

If the birds have not been vaccinated and an outbreak of fowl-pox occurs, the following corrective measures should be taken.

(1) Isolate all affected birds.
(2) Treat birds with closed-up eyes by bathing with a dilute solution of boracic acid powder until open, and place one drop of a 10 per cent. solution of argyrol in each affected eye daily.
(3) Paint the lesions on the comb and wattles with tincture of iodine daily, avoiding the eyes.

The treatment of birds that have fowl-pox is a heartbreaking task, as at its best, it is only partly successful. Therefore the householder is strongly advised to vaccinate his growing stock. Fowl-pox vaccine can be obtained quite cheaply from most poultry requisite stores.

ROUNDWORMS

Roundworms are the main internal parasite affecting poultry, and unsanitary conditions are favourable for a quick build-up of these pests.

Control of roundworms is relatively simple, as many reliable de-worming agents are now on the market.

One very satisfactory vermifuge is tetrachlorethylene, and gelatine capsules containing this drug can be obtained at local poultry requisite stores. The chickens should be de-wormed at ten weeks of age, using a 1 cc. capsule of tetrachlorethylene and at 18 weeks of age using a 2 cc. capsule or two 1 cc. capsules. The capsules are administered on an empty crop by opening the bird's mouth and manipulating the capsule down the gullet with the fingers. This treatment is carried out just before the pullets go to roost, and the droppings are cleaned up the following morning.

Fig. 12.—Portions of the intestines of a bird that was infested with roundworms.

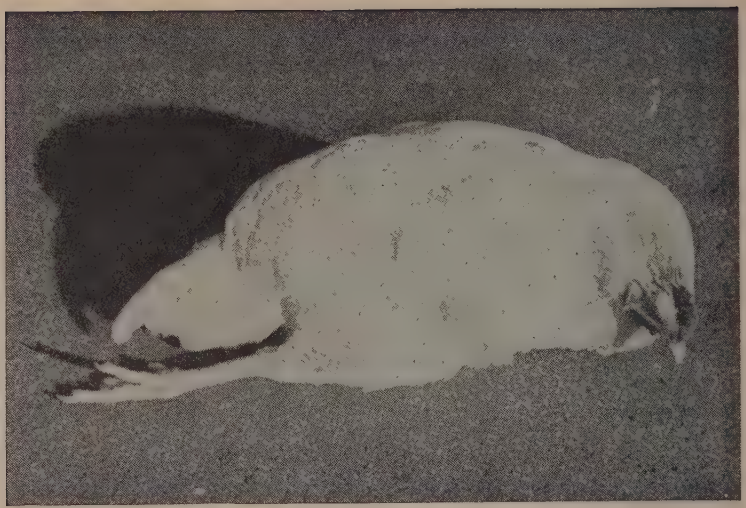

Fig. 13.—A bird suffering from neural leucosis or "fowl paralysis."

There are, of course, other poultry deworming methods, and literature on these methods can be obtained from the Department of Agriculture. Whichever method is used, the growing stock should always be treated at 10 weeks and again at 18 weeks of age as a routine procedure.

LEUCOSIS

One of the most important poultry diseases in the world today is leucosis, a transmissible disease affecting all breeds of poultry in both commercial and small household flocks.

The exact cause of the disease is unknown, but it is thought to be caused by a virus. Unfortunately no cure can be guaranteed.

There are several forms of the disease and the various forms are typified by loss of appetite, the birds wasting away and the passing of fluid droppings. Sometimes a dropsical condition develops and at other times a bird which appears to be quite healthy just dies. On post-mortem examination, a greatly enlarged liver may be seen. Cysts and tumours may develop in the ovaries and with one form of the disease it is common for birds on the point of lay to suddenly show a paralysis of the leg, wing or neck from which they rarely recover.

One leg is sometimes drawn along behind the bird or is extended at right angles to the body. Sometimes the use of both legs is completely lost and the bird wastes away and dies.

A comparatively rare form of the disease affects the eye. The pupil becomes distorted and the eye takes on a pearl-like appearance. Hence the name "pearly-eye."

Fig. 14.—Ocular leucosis or "pearly eye." The bird is blind in this eye.

In odd birds, particularly cockerels, the shank becomes very much thickened sometimes to about three times its normal size.

The best we can hope to do in controlling leucosis is to keep the disease at a low level and one of the most effective ways of doing this is to make sure that each year's chickens are reared on clean ground, in clean quarters and in isolation from adult stock. When buying six-week-old started chickens you should be sure that they come from a started chick establishment where the management and general conditions are not conducive to a build-up of the disease.

Fig. 15.—This bird is suffering from another rare form of leucosis. Note the thickened legs.

The stocking programme and management practices recommended in this article will help in keeping this insidious disease at bay. The proper use of the poultry house will enable each year's chickens to be housed as a separate unit throughout life and it will be noted that during the time in which the chickens have the use of the outside run, the older birds in the next door compartment are confined within the shed and separated from the chickens by a solid partition. The longer a chicken is kept from contacting adult stock, the greater the possibility of it building up a natural resistance to this disease which in some local household flocks have been responsible for mortalities ranging up to 50 per cent.

BUMBLEFOOT

Odd birds may develop lameness and when the foot is examined, the ball of the foot will appear enlarged and inflamed. This condition, which resembles a boil in appearance, should be given similar treatment in that it should not be opened until it is ripe as indicated by the degree of swelling. When this stage is reached, the core on the ball of the foot should be lifted out with a pen-knife, the contents squeezed out thoroughly, and the cavity liberally treated with flavine. The foot with the toes spread, should then be firmly bound up to prevent dirt from entering the wound.

POULTRY PESTS

OF the external poultry parasites, probably the most devastating are the poultry red mite and the fowl tick. Both these parasites are of the blood-sucking type, hiding by day in cracks and crevices in the shed and emerging at night to gorge themselves with blood from the unfortunate bird.

Poultry Red Mite.

Because of their small size these mites which are smaller than a pin's head and grey in colour (they only turn red when they have engorged on the blood of the fowl) are difficult to see, but fortunately their presence can be detected by their excreta which is whitish-grey in colour and which is deposited around the outside of their hiding place. Red mite although not the host of the disease organism which causes tick fever can serve to spread the disease from one bird to another. They are most commonly found on the underside of the perches.

Fowl Tick.

Fowl ticks are considerably larger than red mite, and apart from their blood-sucking activities which weaken the birds, they act as an intermediate host to a disease organism, namely the spirochaete, (*Treponema. anserinum*) which causes tick fever. There is no known cure for this disease, but vaccination against tick fever is now possible. However, as vaccination will not stop the tick from annoying the birds and from sucking their blood, eradication of this pest is the only safe and sure method of control.

To eradicate both red mite and tick, a preparation of 50 per cent. creosote and 50 per cent. power kerosene can be sprayed or painted on the perches and into crevices which may be harbouring the parasites. Care should be taken to see that the spray does not spill or contact the birds in any way. If it does, the birds may suffer severe burning. DDT sprays and those containing benzene hexachloride are also effective.

Scaly-Leg Mite.

This mite burrows beneath the scales of the bird's legs thus causing the scales to protrude and giving the legs a horny appearance. This rough and horny appearance is thought by some people to be due to old age, but this is not so.

Control of scaly-leg mite is relatively simple; first soak the legs in warm soapy water and scrub with a hard brush to soften the encrustations, then apply an ointment of 7 parts of lard to 3 parts sulphur and 1 part kerosene. The treatment should be repeated until all traces of the mite have vanished.

The perches should be sprayed or painted with the preparations mentioned for the control of tick.

Body Lice.

These parasites are small, yellowish, elongated pests that congregate beneath the wings and around the vent of the bird. Control is simple. A thin line of nicotine sulphate (Black Leaf 40) is run along the perches at the rate of 5 oz. to every 100 ft. of perching space, approximately half an hour before the birds go to roost. The treatment should be repeated in ten day's time.

An oil-can is handy for distributing the nicotine sulphate.

Stickfast Flea.

These parasites are most difficult to eradicate from domestic poultry, as treating affected birds can only destroy the fleas which are actually on the birds, whereas it is the flea eggs and larvae which must be destroyed.

The adult fleas attach themselves to the comb, wattles and the bare skin around the eyes of the bird, and the female fleas lay their eggs while in this position.

The larvae which emerge from the eggs develop in the litter and there pupate to emerge as adults.

The eradication of the fleas from a deep litter house involves destruction of the litter, which is most undesirable. Every care should therefore be taken to avoid introducing infested birds.

Where introduction has occurred the following programme is suggested to eradicate the pests:—

(1) Be sure that the poultry house has a cement floor.

(2) Be sure that the sun can penetrate any shaded spots in the yard at some time during the day.

(3) Be sure that the yard is free from rubbish.

(4) Remove all manure from the poultry shed at frequent intervals until the pest has been eradicated.

(5) Smear the heads of infested birds with a non-irritant oil, (Castor oil, etc.).

(6) Pour a little sump oil around the perimeter of the poultry shed. About a six-inch strip should be sufficient.

(7) Be sure that all birds roost above the cement floor, as fleas infesting a single bird which may be sleeping on a gate post or up a tree may lay sufficient eggs to re-infest the whole flock.

CULLING THE "PASSENGERS"

WHETHER it be in large-scale commercial poultry-farming or in the small backyard flock, it obviously does not pay to keep unproductive birds. The commercial poultry-farmer who is consistently receiving less from the sale of eggs and birds than he is paying for poultry-feed, labour and other outlay, can hardly be expected to stay in business indefinitely. In the case of the backyard poultry keeper, while the net loss may not be sufficient to cause any serious financial embarrassment, the continued feeding of birds which fail to "pay their way" is obviously unsatisfactory.

In general, if the small flock has been selected from good stock, little or no culling should be necessary for the first six months of lay. Should any birds moult during the March-May period which is the normal "off period," their egg production will cease but they should be retained as they will probably commence to lay well as the hours of daylight increase.

During the second six months of lay one can expect to find one or two birds which are "passengers" and following on 12 months of continuous laying the rate of culling can be stepped up so that all the birds are disposed of by the 15th or 16th month.

LAYERS AND NON-LAYERS

By observing and handling the birds it is possible to determine, with a fair degree of accuracy which are the layers and which are the "passengers."

Fig. 16.—The bird on the left was in lay. Note the full moist vent and the four-finger capacity between pelvic bones and keel. The bird on the right was out of lay and the vent is dry and contracted. The three-finger capacity of this bird is somewhat deceptive and is due to the presence of surplus fat in the abdomen. This has prevented the abdominal muscles from drawing the breast closer to the pelvic bones. Normally a bird in non-laying condition shows only a one or two-finger capacity.

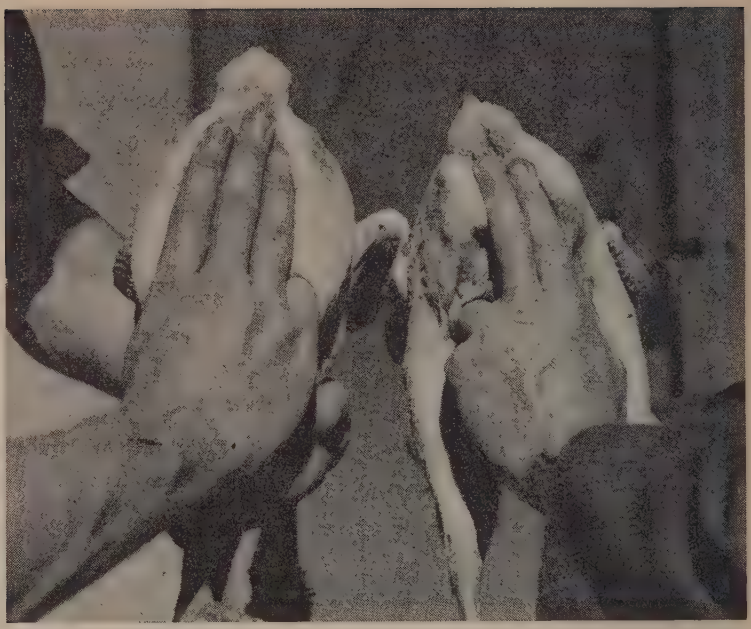

Fig. 17.—Note the flexible pelvic bones of the layer on the left and the three-finger width between them. The pelvic bones of the non-layer (right) are rigid and only two fingers width apart.

The laying bird usually has a bright red comb, and an alert appearance. When handled, the abdomen feels soft and pliable and the pelvic bones are flexible and wide enough apart to admit three fingers between them. The vent is large and moist, and the body is deep from back to keel. The skin is pliable and soft-handling without the heavy "rubbery" texture which indicates surplus fat.

The bird which is "off the lay" often has a shrivelled lifeless comb. Its abdomen will be hard with the pelvic bones rigid and close together (only one or two fingers width apart). The vent of such a bird is usually dry and contracted,

Fig. 18.—Here again we see the thin, flexible pelvic bones and full moist vent of the layer (left) compared with the thick, rigid bones and dry contracted vent of the non-layer (right). The right-hand bird shows the typical "rubbery" condition due to fat accumulations on the pelvic area.

Fig. 19.—Another excellent illustration of body capacity. The layer on the left has a capacious abdomen with a full four-finger spacing between keel and pelvic bones. The non-layer (right) has a contracted abdomen with the keel drawn upward to give barely two fingers' spacing.

and the body shallow from back to keel. Where over-fatness is the cause of non-laying there will be a typical "rubbery" accumulation of fat around the pelvic bones.

In the accompanying photographs dead, plucked birds have been used to demonstrate these points.

OVER-FAT BIRDS

A good layer is invariably a ravenous eater as egg formation makes heavy demands upon the system. If for any reason, the food eaten is utilised for the laying on of fat, the egg production suffers and the bird becomes a "passenger." A ration which is low in animal protein—in other words one which consists mainly of grain with insufficient whalemeal or meatmeal —tends to produce over-fatness. Correctly-fed birds which develop layers of thick, rubbery fat in the abdomen should be culled.

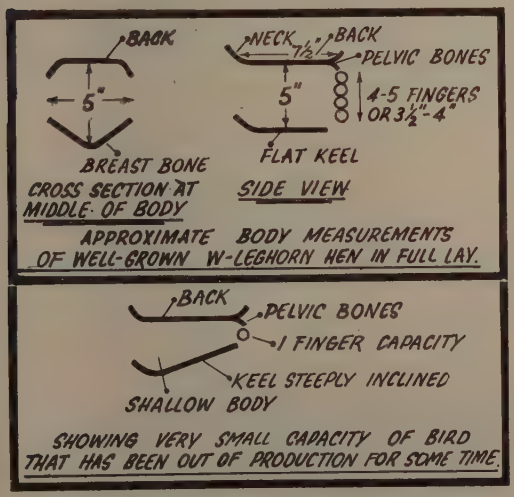

Fig. 20.—Diagrams showing the differences in body conformation of a layer and a non-layer.

BROODINESS

Broodiness, is another cause of decreased egg production but prompt treatment of broody hens will reduce the non-productive period.

The earlier a "broody" is detected and segregated, the earlier it can be brought back into lay. A bird which has been allowed to sit on the nest for a week may take six weeks to return to production. If handled promptly, it can be laying again within two weeks.

The simplest and best method of counteracting broodiness is to place the offender in a "broody coop"—a cage with a slatted floor which prevents the bird from sitting and compels it to perch. (See illustration). The cage should be hung clear of the floor to allow free air circulation round the bird, but if the coop is inside the poultry shed the space between the slats and the litter should not be sufficient to allow other birds to get underneath.

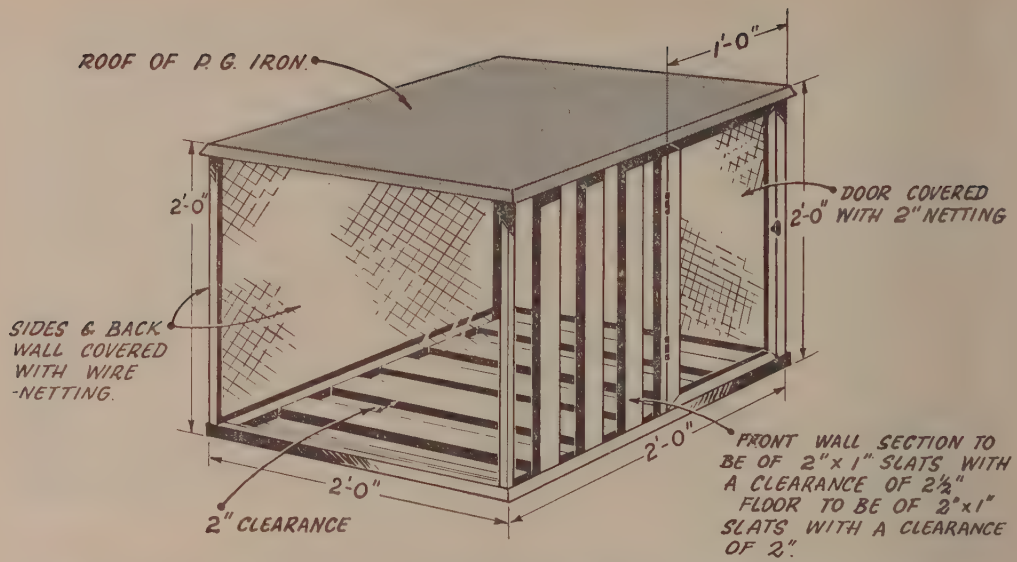
ROOF OF P. G. IRON.
1'-0"
2'-0"
DOOR COVERED WITH 2" NETTING
2'-0"
SIDES & BACK WALL COVERED WITH WIRE -NETTING.
2'-0"
2'-0"
FRONT WALL SECTION TO BE OF 2"x1" SLATS WITH A CLEARANCE OF 2½" FLOOR TO BE OF 2"x1" SLATS WITH A CLEARANCE OF 2".
2" CLEARANCE

Fig. 21.—Constructional details of a broody coop. Provision should be made for food and water, and a suitable method would be to have small troughs hooked outside the slatted front wall section.

If the bird in the "broody coop" lays an egg in the early or later stages of broodiness and this egg can be reached by the other birds, it may encourage the vice of egg-eating. Egg-eating can only be cured effectively by killing the culprit before it has time to teach the other birds.

Always provide the broody hens with adequate feed and water while in the coop. Never subject them to starvation, or other ill-treatment in an attempt to send them "off the brood." Broodiness is a natural condition, and despite all attempts to eradicate it by selective breeding from birds which show little or no broody tendencies, it still persists, particularly in the heavy breeds.

Do not confuse a bird which has developed the habit of sleeping on the nest with a broody bird. Make sure that the hens cannot sleep in the nest by raising the hinged landing-board of the nest each night for a few weeks until the hens all become accustomed to sleeping on the perches. Once this habit is established, the landing-board may be left down without ill-effects.

RAISING COCKERELS

BECAUSE of the small margin of profit per bird, the commercial raising of cockerels for sale as poultry meat is apt to be a somewhat risky undertaking even for experienced poultry-farmers. For the householder, however, who would otherwise pay retail prices for poultry, a few cockerels may be worth rearing during the period when the second shed compartment is not in use.

The purchase of "started" cockerels—six to eight weeks old— adds to the initial outlay but may be advisable for the same reasons as those given in advocating started pullets.

Six-week-old cockerels purchased for about 5s. each during the last week in May should reach a liveweight of about 3½ lb. if kept till 14 weeks old or 4¾ lb. if kept to 20 weeks.

A 20-week-old bird would eat about 8s. 3d. worth of food which, added to the initial cost of 5s., for a started cockerel would total 13s. 3d. Its liveweight would be about 4¾ lb. and dressed weight about 3½ lb.

In other words, the home-produced poultry meat would cost the grower about 4s. per lb. in actual cash expended, as against the normal retail price of about 6s. per lb.

CAPONISING

There are few finer dishes than a well-cooked capon. A capon is a castrated cockerel and for many centuries such birds were produced by surgical removal of the testes.

The testes in the male, and the ovaries in the female secrete chemical substances which are responsible for many of the sexual characteristics. Chemists have isolated these hormones as they are called and reproduced them synthetically.

To-day by inserting a pellet containing female sex hormones under the skin of a young male bird we can cause the bird to assume female characteristics—in much the same manner as if it was surgically desexed.

Fig. 22.—The top picture shows the oestrogen pellets and implanter used in chemical caponising. Below, the pellet is being inserted beneath the skin of the neck.

The treated male bird loses its aggressiveness and there is an increase in the fat content of the blood. This fat is deposited between the layers of muscle or flesh, giving the carcass a well-finished appearance and making it tender and succulent.

The hormones, known collectively as oestrogens, are available in pellet form through most suppliers of poultry requisites and the special implanters are also on sale. The pellets are implanted under the skin high up on the back of the neck.

While under the influence of the oestrogen the cockerels do not crow—and this is an advantage in closely-populated areas.

The effect of the oestrogen is not permanent and most of the birds will reassume their normal male characteristics if not re-treated.

It is usual to implant the pellets when the birds are about eight weeks old and to kill them at 12 weeks. If they are to be held longer than the 14th week, a second injection should be given at this age.

HOME PRESERVATION OF EGGS

DURING the flush period when the hens are producing eggs in excess of the household requirements, it is a good idea to preserve the surplus in order to ensure supplies during the "lean periods."

When large quantities of eggs are to be stored, the best and most efficient system is cold storage. Such facilities however are not available to the domestic producer, and although the home refrigerator can be used for short periods, there is always a possibility that the eggs will absorb flavours from other food stuffs. When long periods of storage are desired, the best method is to preserve the eggs with waterglass or lime, or to use one of the commercial oil-based preparations.

Eggs to be stored should be well-shaped with sound shells, free from cracks and blemishes. Never attempt to preserve fertile eggs or those with thin shells.

The principle of egg preserving is to seal the pores of the egg-shell so that the contents are enclosed in an airtight container. If this is achieved and they are stored in a cool dark place they will keep in good condition for long periods.

Waterglass.

Obtain two clean 4-gallon kerosene tins. Into one, dissolve 2 lb. of commercial waterglass (sodium silicate) in four gallons of boiling water, and mix thoroughly until dissolved. When cool, divide so that both tins contain two gallons. Each tin will hold 15 dozen eggs, and the eggs should displace the water so that at least two inches of waterglass liquid covers the top layer of eggs. This will prevent the eggs from drying out, which is the secret of successful preservation. Cover and store in a cool place and "top up" the liquid from time to time with a reserve of waterglass.

Lime.

The same system is adopted as with waterglass. Dissolve 2 lb. of unslaked lime in four gallons of water (boiled and allowed to cool). The mixture must stand until the liquid is clear and the lime has settled at the bottom. Place fresh eggs in an earthenware jar or crock and pour the clear liquid over them until at least two inches of liquid covers the top layer of eggs. Cover and store away. "Top up" from time to time.

Oil-Based Preservatives.

There are many proprietory brands of egg preservatives on the market and these are particularly convenient to use where only small quantities of eggs are "put down."

Most of them are oil-based and require the egg to be dipped into or smeared with the preparation to seal the pores. The eggs are then placed in cardboard "egg fillers" as used for packing eggs in crates and the fillers are stored in a dark cool place such as a cupboard.

THE EGG—AN ALL-ROUND FOOD

AN egg is a rich storehouse of valuable nutrients, for its contains everything necessary for the developing embryo. Man soon realised that many of the dietary requirements of the human body were readily available in a compact easily-digested form and eggs play an important role in human diet throughout the world. The following analysis shows what a valuable contribution an egg can make towards supplying our bodily needs.

It can be seen why eggs should be a "must" in most domestic cookery recipes and the following recipes are included to help the housewife utilise eggs to advantage. Apart from the usual methods of frying, poaching, boiling and scrambling the recipes detailed below are selected to add variety to the menu.

Nutrients	Daily Requirements for an Adult	Percentage one egg will supply
		%
Protein	70 grams	10
Calcium	0·8 grams	4
Iron	12 milligrams	13
Phosphorus	750 milligrams	15
Iodine	0·1 milligrams	5
Vitamin A	5,000 international units	4 to 16
Vitamin B1	2 milligrams	3 to 6
Riboflavin	3 milligrams	3 to 7
Nicotinic Acid	20 milligrams	3½
Vitamin D	400 international units	3 to 12

CREAMED EGGS

On Toast.

¼ cup flour.
¼ cup butter or margarine melted.
6 hard-cooked eggs, quartered.
Salt and pepper.
2 cups milk.

Method.

Blend flour thoroughly with melted butter. Add milk and cook over low heat, stirring constantly until thickened. Add eggs to sauce, season, heat and serve on toast. If desired, add to the butter two teaspoons Worcestershire sauce or grated onion, or ¼ to ½ teaspoon curry powder.

With Fish, Poultry or Meat.

Make a thin white sauce by reducing the butter and flour in the above recipe to 2 tablespoons each. Use fewer eggs, if desired, and add 1 to 2 cups flaked cooked fish, chopped cooked meat or poultry.

As an Egg Sauce for Fish.

Add 3 finely chopped hard-cooked eggs to the thin white sauce, and serve hot over fried or baked fish.

FLUFFY OMELET

Use 3 Eggs to 2 Serves.

Separate the eggs and beat the yolks thoroughly. Add 1 tablespoon milk for each egg. Beat together the egg whites and a little salt until stiff but not dry. Gradually fold in the egg-yolk mixture. Pour into a frying pan containing melted butter. Cook over a low heat until the omelet is lightly browned on the bottom. Cover and cook until set.

Or, when it is lightly browned on the bottom, finish cooking the omelet by baking in a moderate oven (350° F.) for 10 to 15 minutes, or until browned on top.

Crease through the centre, fold over, and roll the omelet on to a hot platter.

FISH SOUFFLES

2 cups flaked salmon or tinned lobster.
1½ cups white sauce.
3 eggs.
Pepper and salt.

Method.

Add the fish to the hot sauce. Beat in the egg yolks one at a time. Flavour with pepper and salt, and a little finely chopped parsely, if liked. Let it cool. Then fold in the stiffly beaten whites of eggs, and bake 20 to 30 minutes in a fairly hot oven. Serve with hot tomato sauce.

FISH SALAD

1 cup tinned salmon or any cold boiled fish.
2 cups cold boiled rice.
3 hard-boiled eggs.
Lettuce, salt, pepper.
1 tablespoon finely-chopped parsely.
1 teaspoon lemon juice.
Mayonnaise.

Method.

Flake the fish, removing skin and bone. Chop the eggs roughly. Mix with the fish, add the rice, lemon juice and salt and

pepper to taste, and toss all lightly and thoroughly. Place in the centre of the dish, surround with finely shredded lettuce, and pour mayonnaise over.

EGGS AND ANCHOVY

2 eggs.
2 slices of toast.
1 oz. butter.
Anchovy paste.
Salt and pepper to taste.

Method.

Toast bread, while hot spread on anchovy. Make butter hot and break eggs into it, add salt and pepper. Quickly stir to a soft frothy mass. Heap on toast and serve immediately.

EGG VEGETABLE CUTLETS

3 or 4 eggs, beaten.
⅔ cup uncooked oatmeal.
3 cups mixed cooked vegetables.
1 tablespoon chopped onion.
1 teaspoon salt.
Pepper.
2 tablespoons fat.

Method.

To the beaten eggs, add the vegetables, oatmeal, onion, salt and pepper. Melt the fat in a frying pan and drop in the vegetable mixture by spoonfuls. Brown on both sides. Makes 12 cutlets.

POTATO AND CHEESE PIE

3 cups mashed potato.
½ cup hot milk.
4 oz. finely-grated cheese.
2 eggs.
1 tablespoon finely-chopped parsley.
Salt and pepper.

Method.

Separate the eggs. Beat the yolks, and add them, with the milk, parsley and cheese, to the potato. Season with pepper and salt, and beat all together. Whip the whites of eggs to a stiff froth, and fold them into the potato. Bake in a buttered pie-dish, in a good oven for about 30 minutes.

BAKED CUSTARD

3 cups milk.
¼ teaspoon salt.
6 tablespoons sugar.
3 or 4 eggs, beaten.
1 teaspoon vanilla.
Nutmeg.

Method.

Heat the milk over boiling water. Add salt and sugar to beaten eggs. Gradually add the milk to the egg mixture. Add the vanilla and pour into custard cups. Sprinkle lightly with nutmeg. Place custard cups, in a rack if you have one, in a pan of hot water, and bake in a moderate oven (350° F.) for 25 to 35 minutes or until the custards are set (when the point of a silver knife comes out clean). Serve either hot or cold in the custard cups. If desired, top each custard with a spoonful of jelly just before serving.

PAVLOVA

This is a very popular party sweet that is easy to prepare.

6 egg whites.
6 tablespoons castor sugar.
½ teaspoon salt.
2 teaspoon vingear.
1 teaspoon cornflour.

Method.

Beat egg whites with salt stiffly. Add sugar gradually and continue to beat until sugar is completely dissolved. Add vinegar and cornflour gradually. Pipe onto a flat tin covered with well-greased paper. Pipe roses around edge to make wall. Bake in very slow oven for 2-3 hours when Pavlova should be firm on top and slightly soft underneath.

Fill with fruit salad and cream.

GOLDEN ROLL

(For using up egg yolks from Pavlova recipe.)

6 egg yolks.
1 cup castor sugar.
½ cup boiling water.
1½ cups of self-raising flour.

Method.

Beat egg yolks lightly. Add sugar gradually and beat until dissolved, then add water gradually. Fold in sifted flour. Bake in a greased swiss roll tin in a moderate oven for 12-15 minutes. Turn on to sugared paper and cut off edges. Roll and allow to cool. Fill with jam or lemon cheese.

LEMON SWEET

This is an economical and palatable dessert.

3 eggs.
2 lemons.
1 cup sugar.
1 dessertspoon gelatine dissolved in cup hot water.

Method.

Beat egg whites. Beat yolks and sugar, then add gelatine and water. Add juice and rind of lemons. Fold beaten egg whites into mixture and leave to set.

CHOCOLATE EGG NOG

1 cup milk.
1 teaspoon cocoa.
1 egg.
1 dessertspoon evaporated milk or cream.
Sugar to taste.

Method.

Blend cocoa with milk and boil 2-3 minutes. Beat egg yolk and gradually add cocoa mixture. Beat in cream and stiffly beaten egg white—serve immediately.

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- 1 cup margarine
- ½ cup honey
- ½ cup brown sugar
- ⅓ cup milk
- 2 cups flour
- 1 teaspoon baking powder
- 1 teaspoon soda
- 2 cups quick cook oats
- 1 cup chopped raisins
- 1 cup chopped peanuts

METHOD:

Cream butter, add honey and brown sugar, then add remainder of ingredients in order given.

Roll a teaspoon of dough in the hands, place on an ungreased baking sheet, flattening a little. Bake in a medium oven for 15-20 minutes.

This recipe makes about 50-60 cookies.

The Cost and Value of Feeding Stuffs

By L. C. SNOOK, Animal Nutrition Officer

DURING the summer months many stockowners will find it necessary to purchase feeding stuffs. The prices which have to be paid will vary over a wide range according to time and place. It is important, therefore, that the farmer should be able to determine which foodstuff will give the highest return for the money which is paid out.

The farmer who has fodder for sale must also consider comparative values when deciding, for example, whether to sell hay or grain, wheat or oats.

Freight is a major item. Handling charges can be expensive. These additional charges must be considered before decisions are made.

A table has been prepared as a guide to comparative food values. This gives the cost per unit of energy and per unit of protein. The prices used in arriving at

THE COST OF FEEDING STUFFS.

Comparative Costs Per Unit of Energy and Protein.

Foodstuff	Cost	Cost per 100 lb.	Energy Value per 100	Crude Protein Content	Cost per Unit of Energy	Cost per Unit of Protein
	£ s. d.	s. d.		%	pence	pence
Cereal Grain—	per bushel					
Wheat	16 0	26 8	72	10	4·4	32
Barley	11 6	28 0	71	8	3·9	34
Oats	10 0	25 0	60	8	5·0	38
Mill Offal—	per short ton					
Pollard	22 10 0	22 6	75	15	3·5	20
Bran	24 0 0	24 0	65	15	4·4	19
Protein-rich Concentrates—						
Linseed meal	55 0 0	55 0	72	30	9·2	22
Midland meatmeal	40 0 0	40 0	75	50	6·4	10
Whalemeal	60 0 0	60 0	80	60	9·0	12
Dried whale solubles	80 0 0	80 0	80	82	12·0	12
Hay—	per ton					
Cereal hay	12 0 0	10 9	40	6	3·2	22
Meadow hay	12 0 0	10 9	40	12	3·2	11
Lucerne hay	30 0 0	26 9	40	18	8·0	18
Molasses	8 0 0 per 44-gallon drum	36 4	50	....	8·7	....

these values will not apply in all cases but it is a simple matter to make the necessary corrections.

From the table it can be seen that wheat grain at 16s. per bushel of 60 lb. is a cheaper food than oat grain at 10s. per bushel of 40 lb. Also that mill offal at £22 10s. per short ton is cheaper than cereal grains at the prices listed.

It should be remembered, however, that it is difficult to give due credit to all foodstuffs in a simple table. For example, linseed meal at £55 per short ton appears to be a much more expensive foodstuff than meatmeal or whalemeal at current prices. Linseed meal, however, is an excellent supplement to use under hard conditions—it is highly palatable, it is rich in phosphorus, it increases zest in life. In contrast, sheep and cattle often refuse to eat feed mixtures containing meat or whalemeal, despite the high nutritive value of these supplements. Palatability, of course, is a vital factor. A foodstuff is useless if stock won't eat it.

Molasses is often used as an appetiser. This is not a cheap food, however, and in most cases cereal grains or bran could be used with equal effect. As far as is known, molasses is simply a source of sugary material and supplies nothing else of special value to animals.

RAILWAY LIVESTOCK SERVICES

The Railway Department is gaining extra livestock traffic as a result of its vigorous policy of providing every possible service.

In the last six months of 1957, nearly 80,000 sheep were brought from the Eastern States by rail. To expedite transits in this State, special trains were run to Parkeston where a siding has been constructed for interstate livestock. Many of the sheep were stud stock and were brought to Western Australia because of the drought conditions in other States.

Plans are now being made to bring 10,000 sheep from the Eastern States by rail to the new pastoral areas at Esperance.

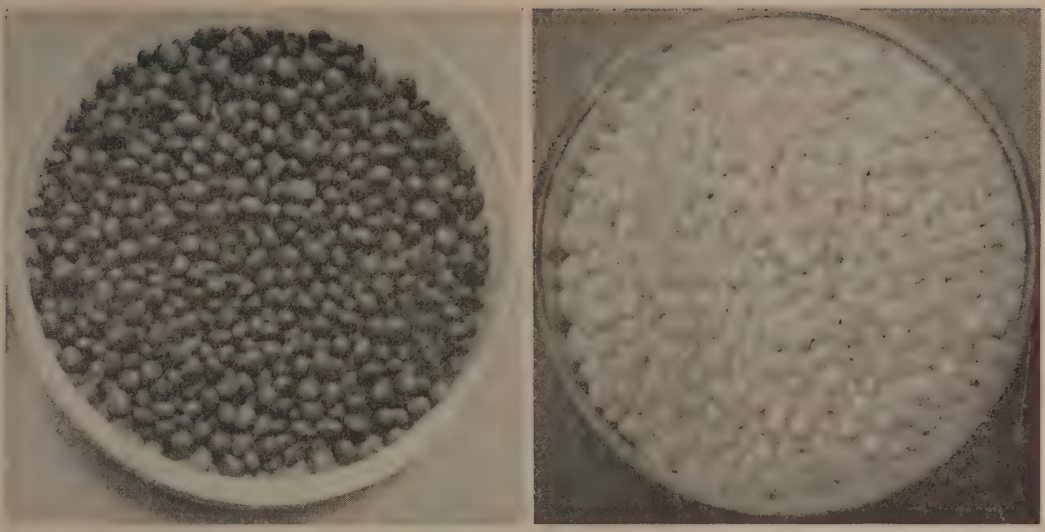
A new livestock trade, the export of goats to Singapore, is being catered for by the provisions of CXB sheep vans for their rail journey from northern lines to Gosnells, where the goats are cleansed. To facilitate their handling at the wharf, they are transported from Gosnells to the ship's side in bogie cattle wagons. The goats are exported for human consumption.

Where no permanent livestock loading facilities exist, the Railway Department can arrange to provide portable sheep race and hurdles. These can be set up to give easy loading between motor vehicles and rail wagons.

In order to provide faster and more direct livestock services the Department has arranged to run large consignments, loaded in bogie wagons at passenger speed. Recent consignments of cattle and sheep from Esperance to Midland Junction in less than 24 hours and of cattle from Meekatharra to Midland Junction in 26¼ hours, illustrate the effectiveness of this facility.

Farmers, pastoralists and stock agents can benefit from this special service by combining their livestock consignments.

Nearly 1,100 modern livestock wagons are now in service on the State railways. These are of sturdy construction and have been specially designed to give safe transport to all forms of livestock.



Left—Untreated subterranean clover seed; Right—Seed pelleted with calcium carbonate

Technical Note

A METHOD OF INOCULATING AND LIME-PELLETING LEGUMINOUS SEEDS

By W. P. CASS SMITH, B.Sc. (Agric.), Government Plant Pathologist, and
OLGA M. GOSS, B.Sc. (Hons.), Plant Pathologist

SINCE the report by Loneragan and co-workers (1), the use of lime-pelleted legume seeds has attracted considerable attention. Many queries have been received from farmers requesting information on the method of pelleting clover seed and its possible application to local conditions.

Seed pelleted by the Loneragan method is available commercially in the Eastern States, but none is produced locally. In view of this, an alternative method, developed and first tested by us in 1948 may be of interest, especially as it may be applied by farmers themselves when test quantities of pelleted seed are required. At that time, farmers in Western Australia, generally endeavoured to complete the sowing of barrel medic and subterranean clover pastures before commencing their cereal plantings and, as the seed after inoculation with rhizobial bacterial cultures, was frequently mixed with superphosphate (in the absence of small seeds attachments) and planted in dry soil, poor nodulation and establishment frequently occurred. A method of protecting the bacteria from these adverse conditions was therefore sought.

Our experiments were all carried out with agar cultures but as similar tested rhizobial strains are now used in commercial peat cultures, there is no reason why results should not be comparable. The following method has been adapted from our original agar method to suit peat cultures of a size sufficient to inoculate 30 lb. of subterranean clover seed.

METHOD

1. Prepare 2 pints of a 5 per cent. water solution of methyl ethyl cellulose (sold

commercially as Cellofas A*) and leave to thicken by standing overnight in the refrigerator.

2. Thoroughly mix and wet the peat culture with ½ pint of skim milk.

3. Thoroughly mix 1 and 2 and inoculate to 30 lb. of seed, stirring until all seeds are thoroughly wetted.†

4. Add immediately, about 10 lb. of finely ground calcium carbonate‡, and stir rapidly until no more will adhere, and the pelleted seeds are well separated. (Cal. carb. equal to approx. 25-30 per cent. of seed weight will adhere to subterranean clover.)

N.B.—When the pelleted seeds are to be mixed with the fertiliser before planting, we always hold them for a least 16-24 hours before mixing, to allow partial drying and setting of the pellet.

With this method, the peat culture is incorporated within the pellet which should therefore afford some protection for the rhizobia when the pelleted seed is mixed with toxic fertiliser, such as superphosphate.

The resulting pellets although relatively soft, will withstand mixing with fertiliser, and when planted at normal depth, are not carried above ground on the cotyledons to any extent.

Tests with this pelleting technique, using agar cultures, in Western Australia, have been confined to barrel medic and subterranean clover and the main results can be summarised briefly as follows.

RESULTS WITH BARREL MEDIC

Better nodulation and establishment are generally obtained from inoculated pelleted seed, than from inoculated seed, when the seeds are mixed with superphosphate fertiliser for planting.

When basic superphosphate is used however, pelleting of barrel medic seed appears to be unnecessary. On lighter soil types, where satisfactory nodulation is difficult to assure, inoculated seed mixed with basic superphosphate generally gives much better establishment than inoculated pelleted seed mixed with superphosphate.

The utility of seed pelleting is likely to be restricted to heavier soil types where it is intended to mix the inoculated seed with superphosphate for sowing.

Good survival of barrel medic rhizobia on seed pelleted with our technique was obtained in an experiment conducted on light acid soil at Merredin Research Station in 1948. The experiment was designed to simulate dry sowing conditions, and for this purpose, certain inoculated seed and fertiliser mixtures were held for three weeks before planting in wet soil. Main treatments and results are shown in the table.

Seed and Fertiliser Mixtures held 3 weeks before planting	Plant numbers	Yield (Dry wt. Gms)
Inoc. barrel medic seed + super	46·4	21·2
Inoc. pelleted barrel medic seed + super	78·2	43·2
Inoc. barrel medic seed + basic super*	190·6	94·4
Difference for significance = ·05	± 38	± 17
= ·01	± 52	± 23

* Basic super was prepared by thoroughly mixing 15 lb. fresh hydrated lime with 85 lb. superphosphate, and matured for 6 weeks before use

These results could be correlated with the nodulation present. With basic super, good nodulation occurred, mostly on the tap roots; with superphosphate it was either lacking or very poor and present on the deeper laterals, and with pelleted seed it was intermediate. Uninoculated seed planted in this area showed no nodulation and the plants were a failure.

RESULTS WITH SUBTERRANEAN CLOVER

Seed pelleting in conjunction with either superphosphate or basic superphosphate, has generally given disappointing results.

In some instances, slightly better first-year establishment has been obtained from pelleted seed, but the improvement has not been maintained in subsequent years.

* Available locally at a cost of 13s. 1b.—sufficient for 30 lb. of seed would therefore cost 1s. 7½d.

† A large clean container such as a tub or wash trough is convenient for carrying out the pelleting.

‡ Very finely ground calcium carbonate is essential for successful pelleting. It is understood that a suitable grade is available locally at a cost of approx. 3s. per 56-lb. bag. The total current cost of pelleting 30 lb. of seed would therefore be approximately 2s. 3d.

However, with subterranean clover, our pelleting tests have been confined to unfallowed newly-cleared scrub plain soils, where, despite the use of tested rhizobial strains and different fertiliser treatments, good nodulation in first-year plantings is the exception rather than rule.

CONCLUSION

Although seed pelleting is apparently giving outstanding results in the Eastern States in some areas, it appears from work conducted here, that, in Western Australia, the method will be restricted in its usefulness. It is therefore suggested that farmers test small amounts of pelleted seed only until benefit is proved under their particular conditions.

Information regarding the results of any such tests would be of interest to the Department of Agriculture.

REFERENCE

Loneragan *et al.* Lime pelleted clover seed for nodulation on acid soils. J. Aust. Inst. Agric., Sci. V21, p. 264.

RABBIT POPULATION INCREASING

The Minister for Agriculture (Mr. L. F. Kelly), said recently that rabbits have at least doubled their numbers during the past 12 months.

This alarming situation had been revealed following a survey of the position by officers of the Agriculture Protection Board. Possibly the estimate was conservative as in some places the increase was much greater, and trappers were operating once again.

An illustration of the remarkable capacity of rabbits to increase was the five successive litters, each averaging five young rabbits, observed in the Lower South-West last year. Even allowing for a high natural death rate each pair of rabbits would increase by at least 800 per cent. Some of the earlier litters would be breeding also, so that the increase was probably 1,000 per cent.

Mr. Kelly added that it is two years since the great plague of rabbits in this State was reduced to the lowest number since they became properly established here. The population is still comparatively low, but the present increase gives a clear warning of what is happening, despite the fact that myxomatosis is still actively assisting in control measures. The same situation has developed in the Eastern States.

While rabbits were still relatively few was the easiest and most economical time to control them, said Mr. Kelly, and farmers are urged to co-operate fully with the Agriculture Protection Board in the organised poisoning programmes which have proved so successful where carefully carried out.

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PERTH AND FREMANTLE

MYXOMATOSIS IS LOSING ITS PUNCH

By A. R. TOMLINSON, Chief Vermin Control Officer

THE results of the testing of field strains of myxomatosis just released by the Australian National University are of vital importance to every farmer in Western Australia. They show clearly that the predicted decline in the effectiveness of myxomatosis has occurred. Worse still, they reveal that the decline has been more rapid in some areas than observers anticipated.

The figures show that only two out of eight samples of the virus taken early in 1956, from diseased rabbits were still Grade II, with a killing rate of 99 per cent. These samples were from Bridgetown and Albany, and were very little changed from the original virus which killed 99.5 per cent.

Samples taken from Tenterden and Pinjarra with another from Albany were Grade III, with a killing rate of 70 per cent. to 98 per cent. This grade of virus is still a good killer, but shows a definite reduction in usefulness from that produced in the laboratory.

Two samples from Dongara and one from Bruce Rock were most significant. They were graded as IV, with a killing rate of between 30 per cent. to 70 per cent., and will not control rabbits.

A very important point is that in Grade II, death occurs in 13 to 16 days; in Grade III, 17 to 28 days and in Grade IV, 20 to 50 days. This means that the rabbits with Grade IV will carry the virus and infect other rabbits for three or four times the period those with Grade II infections will be alive to spread the disease. As a result the Grade IV strain will spread almost four times as rapidly as Grade II, and there is little doubt that this relatively useless Grade IV type will replace the stronger strains.

Rabbits which have recovered from the effects of a weak strain are immune from the stronger strains. These results are what everyone knew could be expected, but it comes as rather a shock to find that myxomatosis is losing its effectiveness so rapidly.

I should imagine that there are few places in Western Australia where there are rabbits without myxomatosis among them. So our problem here is not to spread the disease but to try to stop the weak strains from spreading, so that the more potent types keep on killing.

Probably the only way to do this is to continue to inoculate rabbits with the laboratory strain of the virus. This still kills at 99.5 per cent. and is by far the best type for our purposes. The idea is to carry out the inoculations before the

strains which are already present in the field commence to spread. The weak field strains will immunise the rabbits against the stronger types. I feel that probably the most promising months would be January, February or March in the Northern areas and Lower South-West, and April to June in the Great Southern, Midlands and Eastern districts. This is a rather rough division, but about as close as can be determined.

Ampoules of the highly lethal laboratory virus are available from the Agriculture Protection Board. They are sold to farmers, but issued free to vermin boards. Protection Board officers inoculate rabbits for farmers if enough rabbits are available, while one officer is continually infecting and releasing rabbits.

The end of the very high controlling effectiveness of myxomatosis may be in sight, but there is no reason why we should not continue to get the most out of the disease, and continue to infect rabbits with fresh virus.

At the same time, it is no use blinding ourselves to the fact that the time is past when we could fold our arms and say that myxomatosis will control the rabbits for us. There has been a noticeable increase in rabbits even if they are still nowhere near the previous numbers. It has become very necessary to supplement the controlling effect of the virus where it has been so effective by other methods, particularly poisoning with "1080" and warren ripping. Remember—even two rabbits on a property are a menace.

THE IMPORTANCE OF GOOD SEED IN VEGETABLE PRODUCTION

By T. WACHTEL, Vegetable Adviser, Horticultural Division

THE seed is the foundation of the crop that eventually is to be harvested. As an American textbook on vegetable growing puts it: "Within the seed coat may be locked up the key to future success or failure." A vegetable crop can be much poorer than the seed, but it cannot be better.

The success of the crop is dependent largely upon the genetic characters possessed by the seed, and upon the environment in which the crop is grown. By environment we generally mean such factors as climate, soil, soil moisture, fertility level, etc. These environmental conditions can be controlled, to a large extent, by the grower, or altered sometimes to suit the particular crop. But what we cannot do once the seed is sown, is to alter the inherited properties, the genetic make-up of the seed. Once the seed is sown, we have no more control over one of the most important factors that will determine the future success of the crop. Differences in seeds with regard to inherited characters are enormous. These differences may affect the size and shape of the plant or of the produce, earliness, yield, disease resistance, and many other characters of great economic importance.

The important characteristics of good vegetable seed may be summarised as follows: It must be viable, free from seed-borne diseases and pests, free from weed seeds and foreign matter, and true to type.

Viability means that the seed is capable of germinating well, and strongly enough to produce a subsequent healthy growth. Viability of the seed is determined to some extent by the climatic conditions in which it is planted, its age and storage conditions. Germination tests can be carried out quite simply, by putting seeds between moist blotting paper. But very often seed which germinates well is not viable enough to push the small plant through to the soil surface. To test viability it is a better practice to plant some seeds in a small box of soil, imitating, as far as possible, natural conditions.

Diseases can be carried either on the surface of the seed or inside the seed coat. Some of these diseases can be entirely or partially controlled by seed treatments. Bacterial canker, blackleg and damping-off are only a few examples of the many diseases that can be carried on or in the seed.

Freedom from weed seeds, foreign matter and other vegetable varieties or strains is of obvious importance. Mixtures of different vegetable varieties are a detrimental factor in vegetable production.

As good seed is so important, it is also evident that seed producers must be encouraged to produce good seed, by ensuing that they get a sufficient return. In carrying out a breeding programme and proper seed selection, the costs are high. But here again it is true, that the cheapest article is not necessary the most economical in the long run. In many vegetable crops the cost of seed is only a small percentage of the total cost of growing a crop. It has been estimated that the cost of seed represents only about 1 to 2 per cent. of the total cost for most vegetables. We can readily appreciate that even a small increase in marketable yield would more than repay the extra price paid for reliable seed.

The next question that suggests itself is, whether it would not be a better practice for the grower to save his own seed. The answer is, that saving one's own seed undoubtedly has some advantages, but disadvantages are far more numerous. It has the advantage that it enables the grower to select the plants to suit his own particular growing conditions. It also helps avoid the uncertainties often associated with buying seed of incompletely known origin. But it must be realised that seed production is a highly specialised business, requiring great skill and long experience.

Trueness to type is commonly much more of a problem than purity or viability. To produce seed true to type, certain conditions have to be provided, and these are seldom possible under market gardening conditions, where different varieties and strains of the same vegetable crop are grown in close proximity. Many of the common vegetables are pollinated by insects or wind. Different varieties of the same crop grown for seed must be sufficiently isolated to prevent fertilisation by foreign pollen. Self-pollinated crops, like tomatoes, lettuce, peas and beans, are much easier to work with. For insect-pollinated crops, isolation of at least one quarter of a mile between varieties of the same crop, and closely related crops, like cabbage and cauliflower, is desirable. For wind-pollinated crops, like for instance beetroot, the distance must be even greater. Unless these conditions can be provided, the home production of seed is of questionable benefit.

WATER CONSERVATION ON THE FARM

By J. W. LEWIS, Irrigation Adviser, Bunbury

WATER conservation on the farm is becoming increasingly important in this State, and on most properties in the South-West water can be conserved easily and economically. Coupled with the use of modern spray irrigation systems, this trend may well revolutionise farming methods in years to come and lead the way to greater agricultural prosperity.

Much publicity has been given to "water harvesting" in the Eastern States, and the work of Geddes at Badgery's Creek is familiar to many. Special pumps have been developed, known as "water harvesters," to shift large quantities of water in a short time. This is necessary as the rainfall is unreliable, and creeks may only run for a few days after rain.

In the South-West of this State we have a different problem. Our climate is typically Mediterranean, with a long dry summer and a wet winter. Although the rainfall is very reliable, the ground can only hold a certain amount of water, and a large proportion of it is lost by run-off. The problem is to catch and store some of this run-off for use during the summer months.

There are several methods of conserving water on the farm. Every property has different conditions of topography, geology and soil, and these will determine the best type of structure to be used.

Firstly, the excavated tank. This is simply a hole excavated in the ground, and the ratio of water stored to excavated material is 1:1. Due to this relatively high cost of storing water, it is usually uneconomical to build a dam of this type sufficiently large to hold water for irrigation purposes.

The excavated tank is common in the drier agricultural areas, and is usually used for stock water. It is important that it is placed so that there is sufficient catchment area to fill it during the winter months.

Probably the cheapest method of conserving water is in a turkey's nest or ring dam. As its name implies, it is ring-shaped and situated on fairly flat ground. Due to the method of construction, in which a wall is pushed up in a ring shape leaving the centre untouched, much of the water is stored above ground and the storage ratio is high—usually 4:1 or greater.

The most common method of storing water in the hilly country of the South-West is by damming a gully. A clay-core wall is built across the gully at a suitable place so that a maximum amount of water is held back. It is important that this type of dam be provided with an adequate bypass to carry the normal flow of water once the dam has filled. The water storage ratio will depend on the gradient of the gully, but is usually in the vicinity of 3:1.

Evaporation is usually a problem during the summer months in all types of water storage works, unless there is some replenishment from a permanent running creek, and big water losses are due to this factor. This is especially so in a turkey's nest dam, where there is a large area of comparatively shallow water. The recent development of cetyl alcohol by the C.S.I.R.O. now offers a solution to this problem at a reasonable cost, and a thin film of this chemical maintained on the surface of the water reduces evaporation by as much as 33 per cent.

Although water can be conserved in some way on most farms, it is important to situate the dam or dams with due regard to water requirements and proximity of land suitable for irrigation. Also, water storage works are costly, and it is essential that they be located, designed and constructed in the correct way, so that they will be a lasting asset on the farm in the years to come.

ITCH MITE IN SHEEP

By C. R. TOOP, Chief Veterinary Surgeon

DURING the past 12 months there has been a sharp rise in the incidence of itch mite and many cases have been reported both from sheep markets and individual properties. The symptoms of itch mite infestation are very similar to those produced by lice but, unlike the sheep louse, the itch mite is invisible to the naked eye and the microscopic examination of scrapings taken from the skin after the wool has been closely clipped is necessary for its detection.

The mite inhabits the superficial layers of the skin and sets up an irritation with symptoms of biting and rubbing so that the fleece becomes torn and ragged and loose tassels of matted wool may be seen hanging from the sides and flanks. The affected wool becomes stringy and has a wispy spiral-pointed tip. It often contains particles of crumbling scurf and may show a slight yellowish discolouration. The staple is tender and may easily be broken anywhere along its length. In advanced cases the wool is badly cotted; shearing may be difficult and the value of the fleece is seriously depreciated.

The infection is spread from sheep to sheep by direct contact and it probably occurs soon after shearing when the wool is short and conditions are favourable to the migration of the parasites. The earliest symptom consists of a small whitish patch on the side or flank and from this point the infection gradually spreads over the back and hindquarters

to the thighs. The spread of itch mite through a flock is usually slow and insidious and a period of several years may elapse before a significant proportion of the sheep are observed to be affected.

Dipping with lime sulphur, according to present knowledge, provides the only means of eradication. It should be carried out two to three weeks after shearing and a wetting agent should be added to the dip to ensure thorough saturation.

The arsenical dipping fluids will not eradicate itch mite, but they do suppress the infestation and reduce the mite population to a level where it is unlikely to produce any ill effects. Symptoms are rarely reported in flocks which have been dipped with arsenic as an annual routine and certain dips which contain rotenone are reported to have the same effect.

The dieldrin and aldrin dips, on the other hand, have no effect upon the itch mite, and while these preparations are used, the infection will continue to spread. This is an unfortunate development because both dieldrin and aldrin are highly effective against lice and keds and, in addition, protect the sheep against blowfly attack for a period of about three months.

In approaching the problem we must consider not only those flocks showing signs of infestation but also the many other flocks which, although harbouring the mites, have not yet developed symptoms. A return to the arsenical dipping fluids and jetting against blowflies as a separate operation with dieldrin, aldrin or diazinon would provide a solution, but this might be regarded as a retrograde step. Alternatively the flock could be dipped on one occasion with lime sulphur, which would eradicate the mites, and dipping with dieldrin or aldrin could then continue, but it would be necessary to guard against the reintroduction of the infection with bought in sheep. The lime sulphur dips do not destroy lice or keds. They are very irritant and have to be used with care and are unlikely to appeal for general use—and the fact that they may be combined with dieldrin and aldrin does not seem to help very much.

An insecticide, which will destroy lice and keds as well as itch mite and, at the same time, afford a reasonable degree of protection against blowflies is obviously required and this must continue to be sought.

ORCHARD IRRIGATION

By J. CRIPPS, Horticultural Adviser

THERE are no fruits grown in Western Australia which do not give larger crops if irrigated, although the majority of fruit growers do not have irrigation installations.

Today I am not going to deal with dams and sprinklers but am assuming that the grower realises the advantages of irrigation in orchards, which are—

(1) Larger crops.
(2) Better quality fruit.
(3) Larger trees, due to greater growth.
(4) Assured return for expenditure.

This last is important for capital expenditure and expenditure to cover normal running expenses may be wasted to some extent if crops are reduced by lack of water.

Fruit growing should not be a risky enterprise. By disease control, correct cultural management and irrigation, most of the risk should be removed and a regular crop assured. This in turn enables the organisation and management of the orchard to be built round a certain production which is achieved regularly year after year, so that a known quantity of labour and materials are required at any one season, mistakes are minimised and smooth running assured.

Having mentioned the advantages of irrigation we will now assume that the orchardist has an efficient sprinkler irri-

gation system and the next question which arises is, "How much water to apply and when to apply it?"

A guide is necessary if water is to be applied when needed. Some orchardists tell me that their supply of water is limited and that they merely apply all they can, after which the trees have to survive as best they can. A method of calculating the available soil moisture would in this case ensure that none of the limited supply of irrigation water was wasted and would enable the orchardist to determine whether or not it would be profitable to acquire an additional supply. That is, whether the marginal cost of the work involved in the storing of more water or the sinking of an extra bore, would be less than the marginal revenue obtained from the increased crop resulting.

If sufficient water is available, its application may be governed by the appearance of the trees, but when fruit trees show signs of moisture stress, the desirable period for the application of water has passed and some damage has been done. Neither is the appearance of the surface soil a good guide. A soil auger may be used to gauge the available moisture present in the soil below the surface, but this work is time-consuming and requires considerable skill. What other methods are available?

Well, one can estimate soil moisture loss by calculating the difference between rainfall and evaporation, but this method is difficult and by no means foolproof. Is there then, a reasonably foolproof method of discerning when to irrigate and how much water to apply? I think that there is and this method involves the use of a simplified tensiometer for measuring soil moisture. Moisture in soil is held by tension and this tension increases as the quantity of moisture present decreases, until it is so great that the small quantity of moisture remaining cannot be taken up by plants. Not all moisture present in soils is available to trees and plants. The tensiometer measures soil moisture tension and therefore from its readings the amount of moisture actually available to crops can be estimated. A simplified version of the tensiometer is available and is known as the Irrometer. This irrometer has several important advantages. It can, and should, be inserted in the soil and left in position throughout the summer months. The soil moisture present is indicated by a dial divided into units one to a hundred so that reading is simple.

A reading of seventy indicates that virtually no moisture is available to the trees and one of nought, that the soil is saturated. In actual practice, irrigation should commence at a reading of between 50 and 60 and should cease at between 0 and 10.

Since the main root zone of a fruit tree normally lies at a depth of between four inches and three feet, it is suggested that the two irrometers be placed close together at depths of one foot and two feet three inches, to measure moisture conditions near the top and the bottom of the root zone. Two irrometers per acre is the recommended number, but a smaller number would give valuable information.

The cost of these irrometers will be approximately £32 per acre if the recommended number is employed, but they should last for at least five years with careful handling, so that the annual depreciation of an installation will be £6 8s. per acre. The annual cost of insertion and reading will be approximately £2 15s. making an annual total of £9 3s. per acre. It is suggested that this annual cost will be more than covered by savings in time, labour and fuel occasioned by a reduction in irrigation when not required and/or increases in crop value and quality occasioned by the provision of adequate moisture when it is required.

The use of two irrometers experimentally in one orchard in the hills area has shown that the greatest need for water is during the month before harvesting commences. Fruit trees, and in particular stone fruit, should, however, be watered after the crop has been picked to ensure fruit bud development and a good crop during the following year.

Further information on the use of irrometers can be obtained from the Department of Agriculture.

POWDERY MILDEW DISEASES IN THE HOME GARDEN

By OLGA M. GOSS, B.Sc. Hons., Plant Pathologist

MOST of you will be only too familiar with the powdery mildew diseases which occur so frequently during the warmer months in your gardens. The most common plants badly affected by these diseases are grape vines, roses, hydrangeas, delphinium, lagerstroemia and melons of various types.

For those of you who perhaps, do not recognise the disease by name, a short description of its appearance will doubtless call it to mind.

Powdery mildew is easily recognised, for it forms a quite conspicuous, dirty-white, powdery growth on the surface of infected leaves, green stems and fruits, which is easily rubbed off with the fingers. Although the fungus is mainly on the surface, it sends out feeding structures which enter the leaf tissue and rob it of food and water so that it tends to shrivel and become distorted. Infected leaves gradually dry up and finally fall to the ground. The powdery surface of the mould really consists of myriads of tiny fungal seeds called spores which are capable of causing new infections when conditions are suitable—wind acting as the main agent of dissemination.

The disease spreads most rapidly when weather conditions are warm—i.e. 75°-90°F, but not too hot, and when light intensities are reduced by shading, etc. This means that the parts of the garden most conducive to the spread of the disease are those which are sheltered from the sun and wind and where plants are too crowded, or pruned to give very bushy growth. With some plants, e.g., roses and hydrangeas, humidity also seems to be important. In most home gardens the regular use of sprinklers induces ideal conditions for spread of mildew both by building up humidities and by lowering leaf temperatures. However, some control of this aspect can be obtained by regulating the watering, applying water at a time when the foliage will dry off fairly quickly and avoiding wetting the leaves as much as possible.

Mildew is a striking example of the old adage "Prevention is better than cure" for one established in the garden, it is very difficult to control. Efforts therefore should be directed to preventing its occurrence.

To do this, rake up and burn all prunings and fallen leaves from woody perennials, such as vines, roses, hydrangeas, etc. Then spray the pruned plant with a strong sulphur spray, e.g., lime sulphur, at the rate of 1 part lime sulphur to 10 parts of water for vines or roses—or 1 part to 20 parts for hydrangeas. This practice of strict garden hygiene and dormant spraying is of vital importance, for all spores in the immediate vicinity of the plant including those on fallen leaves and in bark crevices are destroyed, so reducing the chances of early infection of new growth to a minimum. However, some infection may still occur from dormant mycelium actually within the buds.

During the growth period, all plants liable to be attacked by mildew should be sprayed or dusted regularly—once a week to once a fortnight. For most plants the most suitable materials include lime sulphur, wettable sulphur, livers of sulphur or karathane if a spray is required; or flowers of sulphur if dusting is preferred. In the case of rockmelons and cucumbers however, sulphur cannot be used as it causes injury, but copper compounds or karathane give good control. Sulphur can be safely used on other melons such as pumpkins, etc. When using sulphur, do not spray or dust at a time when the plant is stressed for moisture as damage may result. In the case of roses, increased control of mildew has been obtained by using a combined copper-sulphur spray at

half rates, e.g., copper-oxychloride ½ oz., wettable sulphur ½ oz. in 2½ gallons of water.

To briefly summarise the control methods—

(1) Practice strict garden hygiene.

(2) Apply a dormant lime sulphur spray.

(3) Spray regularly during growth. Do not wait till you notice the disease—by then it is very difficult to cure.

(4) Control watering—if possible picking times when the foliage will dry off quickly, and avoid wetting the leaves as much as possible.

Further details on the identification and control of these diseases may be obtained from the Plant Pathology Branch of the Department of Agriculture.

"CAT FLU"—A MATTER OF SERIOUS CONCERN

By J. SHILKIN, B.V.Sc., Veterinary Surgeon

THE importance of cats in the community is not generally realised by the public, yet severe epidemics among the feline population should be a matter of considerable concern. The presence of a reasonably large cat population in our cities is most important in keeping rat and mice numbers down to a low level, and their importance on farming properties is too well known to need any comment. Rat-borne diseases do occur in man in Australia and rats are always a potential danger as carriers and spreaders of some extremely serious diseases of man.

Diseases which may affect the cat population of any country are therefore quite important and the most serious of these are the diseases which are loosely known as "cat flu."

The term "cat flu" seems to be firmly established among cat owners and the public generally, but the group of diseases which this term covers would more properly be described as the feline distemper group.

Contrary to general opinion "cat flu" is not one disease but at least three and possibly more separate diseases. Considerable research and discussion have gone on in the veterinary profession both in Australia and abroad in an endeavour to establish how many clearly defined diseases would come within the category of the term "cat flu." While complete clarification still does not exist, it would appear that we can somewhat arbitrarily divide the feline distemper group of diseases into three fairly well-defined and separate conditions—infectious feline enteritis, infectious feline catarrh and contagious ulcerative glossitis.

I would like to deal with these conditions separately and give you some idea of the causes, symptoms and treatment in each case.

Infectious Feline Enteritis—known also as Panleucopenia.

This is a highly contagious, usually fatal disease of young cats characterised by a sudden high temperature, dehydration, (a drying out of the tissues)—and marked destruction of the white corpuscles of the blood, which is responsible for the alternative name for the disease—panleucopenia. It is caused by a virus which may also affect a number of the wild and zoo animals.

Animals, affected are generally in the age group of about 5 to 12 months and it is possible that very young kittens possess an immunity which later wears off. Older animals may possibly have either recovered or have developed an immunity in early life.

The main features of the disease seen in this State are high fever, prostration and rapid loss of condition. Vomiting may occur and cats appear to resent handling, which at times gives the impression of causing acute pain. Affected cats will not eat or drink and usually lie prone on the abdomen with the head on the front paws. Death may occur within two or three days, sometimes more quickly.

With the advent of the newer antibiotic drugs, following upon the discovery of

penicillin, the chances of successfully treating affected cats have been greatly improved. In fact with early and correct treatment up to 80 per cent. of affected animals may be saved. As these drugs are not available to the layman, treatment should therefore be carried out by a veterinary surgeon if at all possible. However, where veterinary services are not readily available, particularly in country areas, owners must necessarily do what they can themselves.

In treating sick cats generally it is always a good plan to handle and restrain them as little as possible. With feline enteritis, however, a certain amount of fluid is desirable but this may be given quickly and with little handling. A weak solution of vegemite, say half a teaspoonful in a cup of water may be given in half teaspoonful doses every hour. This solution in small doses is usually retained by the animal. If the throat appears to be sore as is often the case, a little penicillin suspension which is the preparation used for mastitis in cows and which is frequently stocked, particularly on dairy farms, may be squeezed out of the tube onto the back of the tongue. Apart from these measures it is advisable to do little else.

Preventive treatment in the form of a vaccine is now available in Australia. This consists of two injections, the first of which is preferably given when the kitten is about six weeks old and the second 10 to 14 days later. Vaccination, of course, requires the services of a veterinary surgeon.

Infectious Feline Catarrh.

The next disease in the feline distemper group is infectious feline catarrh—also known as pneumonitis and influenza. This disease may be more properly labelled "flu" than either of the others as it more closely resembles influenza as we know it in man. It may occur in cats of all ages and usually the mortality is fairly low. However in young cats particularly those which have recently undergone surgery—usually castration or removal of the ovaries—a mortality may be fairly high.

Symptoms generally consist of sneezing and coughing with a discharge from the nose and eyes, while the appetite may or may not be affected depending on the severity of the condition. It is a highly contagious disease and in older cats may be chronic and of fairly long duration if not treated.

Here again veterinary treatment is desirable as penicillin and sulpha drugs are often helpful. However where home treatment must be carried out, aspirin, one tablet twice daily, may be useful. Careful nursing is important and this requires that the animal be kept warm and occasionally tempted with food. Water should of course, be readily available. If the appetite is lost, small quantities of vegemite in water as suggested previously may be of advantage.

In this condition, inhalations of friars balsam frequently relieve the nasal discharge and generally bring about improvement. Whilst this can be carried out in a box or covered cage every care must be exercised to see that the cat cannot upset the container of friars balsam. Here again, penicillin suspension may be used if the throat appears to be sore.

Contagious Ulcerative Glossitis, also called infectious stomatitis.

This disease occurs largely in mature cats and as the name implies the main symptom is an inflammation of the mouth. Drooling of saliva, a wet chin, loss of appetite and a foul breath are the first symptoms usually observed. Later, the tips and edges of the tongue may be seen to be inflamed, and later still, small ulcers appear on the upper surface of the tongue. Death seldom occurs but the cat has difficulty in eating and drinking and becomes somewhat emaciated.

Penicillin injections frequently have a good effect on this disease so that here again veterinary assistance should be sought wherever possible. Where this is not possible penicillin suspension, as previously mentioned, squeezed into the mouth several times a day should help to relieve the symptoms.

In all types of "cat flu" it appears to be an advantage to withhold milk until the animal is well on the way to recovery.

The essentials of treatment in all cases can be summed up as veterinary assistance wherever possible, as little handling as possible, and careful nursing.

EVEN GOOD FARMERS CAN CAUSE EROSION

By BRIAN MARSH, B.Sc. (Agric.), Soil Conservation Adviser

THE particular aspects of soil conservation I am to discuss has not been publicised before, and the suggestions contained in this talk may be of use to you during seeding operations this year. It is often asked, "Will the use of clover really prevent erosion."

If all farmers used a clover rotation now, and had been doing so for 40 or 50 years, there would still be a great number of erosion gullies formed and still forming.

Most gully erosion we see on our travels in the wheatbelt, is in the form of gullies in the depressions and natural watercourses arising from catchments of from 50 to 500 acres. There is more of this type of erosion than of the rilling and gully networks we see extending up the hillsides.

Most watercourses were once smooth depressions capable of being crossed, unfortunately, by farm machinery. Now many of them are gullied and act as focal points for extension of erosion.

Many people say that the trees should never have been cleared from these depressions. That is true, and if that policy had been followed, much of the present erosion would not have taken place; however, these depressions are capable of supporting good pasture which is more profitable than trees and even better able to withstand erosion. The cause of the erosion has not been the clearing of the trees, it has been the subsequent cultivation.

How does this erosion take place? Firstly; water most easily moves loose or cultivated soil. Secondly; in depressions we often get flows of water capable of moving cultivated soil *whether it is clover country or not.* Thirdly; it is not yet an accepted farming practice to keep out of watercourses when cultivating.

Good farmers, not realising these points do cause crosion. By good farmers I mean those using pasture improvement practices, using sub-clover and eliminating fallow. These practices do tend to greatly reduce runoff in most rains, but heavy rains do occur quite often and these cause water to flow in the hollows. If the soil is loosened by cultivation it can be moved by flowing water. Most farmers cultivate depressions with no thought for the possible consequences. I must ask you to think of your own case—you have almost certainly cultivated around the head of a gully in a hollow; . . . . isn't the presence of that gully certain indication that erosive water has flowed and still can flow over your cultivation.

You have a choice. You can leave a permanent grassed waterway, or leave a brown erosion scar.

As something like 80 per cent. of the watercourses are already scoured like this, I'd better try to give you some idea about fixing the damage.

Here in Western Australia we have developed a method of safely treating such gullies. Isolated gullies without very large catchments, can be filled and grassed over without diverting the water elsewhere, but a gully can't be filled without protecting the loose fill from running water.

Short spreader banks are built over the filled gully. These banks are about two feet high and about one chain long and are arranged so that water flows on to grass on one side of the gully. This water then flows back towards the gully where it is picked up by another bank and so on. After treatment the gully filling is seeded to pasture and then left permanently out of cultivation as it should have been in the first instance.

This type of treatment and the use of contour banks on extensive gullying help to cure erosion. The use of long rotations using fertility building pastures helps to prevent erosion.

Their combined use will never do a complete job of soil conservation, until it is recognised generally that cultivation of natural waterways is a bad thing. I advise you, when seeding this year, "If in doubt, leave it out," and if you are still in doubt, seek the advice of the Soil Conservation Service.